SCIENTIFIC AMERICAN

SUBMARINE CREW EQUIPPED WITH SELF-CONTAINED DIVING SUITS, CLIMBING UP THE CABLE OF A BUOY RELEASED FROM THE WRECK

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

A Submarine "Curtain of Fire"

AT the opening of the great world war the submarine played so conspicuous a part as to gain for itself a reputation far greater than it deserved. Since then we have not heard so much of its operations against war vessels, and there has been much speculation as to the means used to combat this most modern development of naval warfare.

Recently an account appeared in one of the daily newspapers of a high explosive shell developed by the British, which would not ricochet and which would detonate only on reaching a predetermined depth below the surface of the water. According to the account, a battleship fleet protected itself by a so-called "curtain of fire." The shells were rained into the sea along a line about two miles or so from the fleet and these shells would sink to a distance of about twelve feet under the surface before exploding. The fuse was a capillary tube which drew up water into contact with a pinch of potash, so that it was the sea itself that caused the shells to explode. It was claimed that a wide area of destruction would be produced which would crush all submarines in the vicinity.

It is never safe to ridicule an invention until a full description of it is obtained. However, it must be self-evident to any thoughtful reader that this newspaper account of submarine shelling must be taken *cum grano salis*. In order to accomplish its purpose, the shell would have to contain a sufficient quantity of explosive charge to assume the function of a small torpedo or mine. It would have to be of the proportions and weight suitable to be fired from a gun with the probability of obtaining the range desired. Experiments have been made by our own Government with a shell containing a large amount of high explosive, but it was found impracticable to fire this shell to any great distance because it was not heavy enough to permit the generation of sufficient pressure in the firing charge of the gun before the projectile left the muzzle. If the projectile be made heavy enough to permit of its attaining the desired range, it would probably sink so fast when striking the water that it would be very difficult to gage a fuse which would detonate it at the proper depth. The newspaper account refers to the new shell as one that does not ricochet on the water. This, of course, is not a property of the shell, for any shell will ricochet if it strikes the water at a small angle from the horizontal. To prevent it from ricocheting, the shell should be fired at a high angle, as out of a mortar.

As to the effectiveness of submarine shells there seems to be considerable misapprehension. When the shell is detonated under water a pressure is exerted, of course, in all directions, but a vent is found directly upward when the shell throws a column of water. Theoretically, the destructive radius of the detonated shell would be no greater than its depth under the surface. In other words, if the shell exploded at the depth of twelve feet it would not do any material damage to surrounding vessels unless within twelve feet of the shell. From this it will be seen that in order to injure the submarine the shell must virtually graze the boat.

In order to produce the "curtain of fire" referred to, a very large store of ammunition would be required, otherwise the "curtain" would be very ineffective. This would require large additional magazines in the battleships. The use of this equipment would only come into play after the battle fleet's screen of scouts, torpedo flotilla and aeroplane service had been dodged or been put out of action. This would be a desperate emergency indeed.

Altogether the engagement of the battle fleet with a submarine flotilla would be such an unlikely contingency that dependence upon the present means of defense would be sufficient. Owing to the great obstacles to be overcome in delivering the shell at the point of effective use, and owing also to the small radius of effective action of the shell, it is hardly to be expected that this method of submarine defense will get beyond the experimental stage.

Should Science Teaching Be Reformed?

OUR English contemporary, *Nature*, in one of its recent issues, published some animadversions on the methods of science teaching in vogue at the present day, as compared with those of a generation or two ago. Whatever pedagogues may have to say in reply, it is certain that these criticisms will strike a responsive chord in the minds of many persons, themselves neither pedagogues nor men of science, who feel that they have not carried away with them from their own schooling just the kind of acquaintance with the sciences that they should like to possess.

The burden of the complaint may be gathered from the following extracts: "Twenty years ago or so much more attention was given to the attractive side of science than is now the case. . . . School science as at present taught, and as defined by examination syllabuses, seems to proceed on the assumption that every pupil is to become a skillful experimenter, or an original investigator, in the realms of Nature. . . . In their anxiety to impress pupils with a sense of scientific accuracy and cautious conclusion, advocates of the methods now in vogue have forgotten that it is even more important to present a view of science which shall be human as well as precise."

To make a long story short, *Nature* protests against the practice of focusing the attention of the average pupil, who is seeking a general education, upon a small part of the field embraced by each of the principal sciences, with insistence upon a considerable amount of laboratory work and other expedients for developing rigidly scientific habits of mind, in lieu of the old-fashioned method of imparting a superficial knowledge of the science as a whole.

Nature perhaps underestimates the time that has elapsed since the old plan was in vogue. The present writer looks back twenty-five years to a one-semester course in botany, taken in the high school of one of our large cities, during which he became quite expert in dissecting seeds and in staining tissues for inspection through the microscope, but at the end of which he had not learned to recognize at sight a single common wild flower. Moreover, this method of teaching botany—which, for aught that it contributed to one's stock of interesting and useful information, might have been profitably replaced by the one employed by the late Mr. Squeers (if memory serves us, Dotheboy Hall botany consisted in weeding the garden, which at least got one in touch with Nature)—this lopsided method of teaching botany was quite an old story even in those days. Probably we must go back at least half a century to reach the time when nobody studied botany without acquiring a bowing acquaintance with the local flora; when a course in astronomy ensured the pupil a fair knowledge of the constellations, and even of the mythological stories that pertain to them, together with such picturesque (and sometimes apocryphal) episodes in the history of the science as the Papal excommunication of Halley's comet; when physics (then "natural philosophy") was not all formulas and problems, but was fraught with all sorts of necromantic marvels, from Rupert's drop to the Magdeburg hemispheres (tame, indeed, compared with the magic of radioactivity, electromagnetic waves, and what-not, available for making present-day physics a fascinating study, but so sparingly used for that purpose.)

In short, with the marvelous expansion that has occurred in every branch of science, the means are at hand to-day for making elementary science teaching far more enriching to the mind, far more pregnant with valuable as well as interesting information, than it was in the days of our grandfathers—yet we have a strong impression that it is actually far less so.

Let us not depreciate mental discipline—the fetich of modern pedagogy. It is well that our school children should have their minds trained by dry gymnastic methods, even as the fingers of the pianist are trained with five-finger exercises. But after the pianist has made a good beginning in "technique," he embarks upon the more attractive task of acquiring a répertoire. The study of science—in the case of the average man—too often never gets beyond the stage of five-finger exercises.

Of course there are two sides to this question. Our only contention is that the rebound from the extreme dilettantism of the older methods of instruction has carried our science teachers too far in the other direction.

Utilizing Horses Slain in Battle

THERE has been an enormous loss of horses during the great war. During the first period of the conflict there was little effort at utilizing the flesh and skin of the carcasses. The compelling idea was to get them buried when the carrion began to pollute the air, and worse still, to become a breeding ground for myriads of flies. More recently, however, the thrifty German mind has been taking thought of the economic value of flesh and hide, bone and hoof.

The question has been made the subject of an article by Mr. Heyking, the Director of the German Fisheries in the *Deutschen* Fishereikorrespondenz. This article bears the title "Horseflesh as Food for Men and Animals." Its author deplores the fact that there should be such a wide-spread and unreasonable prejudice against the use of horseflesh as human food. To our minds it seems probable that this prejudice is largely due to the sentimental associations which have gathered about the horse for untold generations as the friend and companion of man in times of peace, and his gallant and helpful comrade in time of war. Dr. Heyking, however, ascribes the feeling mainly to an instinct founded originally in religious prejudice. He says, as quoted in the *Kölnischer Zeitung* (Cologne): "The ancient Germans and Scandinavians esteemed horseflesh very highly, and the horse was the sacrificial animal most prized, its skull being nailed to house doors and roofs as a memento of the Feast of Freya. It was probably this connection with the old heathen sacrificial uses which caused the Christian priests to forbid the eating of horseflesh." While this may have been partly the reason for abandoning horseflesh as food, it seems likely that a more direct cause was literal acceptation of the Mosaic law banning as unclean certain animals. At any rate Pope Gregory III formally denounced the horse as an unclean animal for food purposes. Naturally enough the prejudice, however created, has become in the course of generations an instinctive repulsion in most people. In times of famine, however, hunger has often proved stronger than the prejudice. Horseflesh was eaten freely by the hunger-smitten populace in 1816-17 in Germany and Switzerland, in 1847 in Berlin, in 1863 in East Prussia, and in the siege of Paris in 1870.

However, a strong feeling of aversion to this food still lingers, though many scientists including Prof. Esser of Göttingen, recommend it as a cheap and good popular food. To promote its use Prof. Esser advises that butchers and dealers should be required to keep it on sale, though separated and plainly labeled, just as kosher meat is kept separate, and margarine is separated from butter.

Dr. Heyking advises that battlefields should be searched for slain and mortally wounded horses, that they should be promptly skinned and the meat packed in sacks which have been saturated with a solution of permanganate of potash. He says: "By this means it will retain its freshness for a couple of weeks. The French employed the same method in 1820, in order to preserve it for human food. The papal ban has never reached the ears of the peoples of Asiatic Russia, Tartars, Calmucks, Kirghese, and others, and they still eat it with pleasure. A vast quantity of colt skins come thence to the west to be marketed.

"On this account conserved horseflesh should be used to feed the million and a half Russian prisoners in our hands, since they would gladly eat it. In any case it would be better than the frozen Canadian or Argentine meat which is set before our countrymen in English prisons, and whose odor and condition rouse such complaint. In conclusion, Dr. Heyking describes a process for making excellent fish food from horseflesh."

The Alleged Allotrophy of Copper

MUCH interest was aroused recently by the announced results of dilatometric experiments by Prof. Ernst Cohen and W. D. Hulderman, leading to the conclusion that copper exists in two allotropic forms, having a transition point at 71.7 deg. Cent. to 69.2 deg. Cent., under varying conditions of fineness and previous contact with an electrolyte. (See SCIENTIFIC AMERICAN SUPPLEMENT, December 25th, 1915, p. 410.) These observations, if verified, would be of far-reaching industrial as well as scientific importance; hence the matter has been investigated at the U. S. Bureau of Standards by Messrs. Burgess and Kellberg, who used an electric resistance method. The details are published in the *Journal* of the Washington Academy of Sciences. These experiments do not confirm the results announced by Cohen and Hulderman, but show that an allotropic transformation of copper at about 70 deg. Cent. does not exist, that the resistance of copper in the range of 0 deg. to 100 deg. Cent. varies continuously, and ordinary copper is most probably not in a metastable state. The authors point out that "it is extremely regrettable that such a far-reaching and disquieting announcement as the metastability at ordinary temperatures of a metal so widely used and extremely important in exact measurements" should have been given out on the basis of a few inconclusive measurements.

Aeronautics

New Seaplanes for the Navy.— It has been recently announced that the United States Navy Department has placed an order with a prominent American aeroplane manufacturer for six steel hydro-aeroplanes, which are intended for service at the Pensacola Naval Aeronautic Station. The fuselages, pontoon frames and control surfaces of the hydro-aeroplanes are to be made of steel.

The Efficiency of Parachutes in saving the lives of aeroplane pilots appears to have been proved in the recent demonstration of Colonel Maitland of the Royal Naval Air Service, who jumped from an aeroplane at an altitude of 10,000 feet and landed safely, thanks to the parachute of special design which he used. It required 15 minutes for the descent.

New French Anti-Aircraft Gun.— According to *Aeronautics*, it is learned from Allied sources that a new anti-aircraft gun recently adopted by the French armies has given the most satisfactory results. In its general lines, the gun resembles the famous 75 mm. quick firer; its recoil is rather less than 3 feet and the shell it fires weighs 35 pounds. The projectile is fired at a muzzle velocity of 1,870 feet per second.

France a Purveyor of Aircraft and Airmen to Her Allies.—According to a recent statement in *Le Matin*, there is to be a meeting of the Anglo-French aviation corps chiefs once a month at Paris. The meetings will be attended by representatives of the other Allies, in order that unity of direction may obtain in the air service of the Entente nations. Carrying out the plan still further, Russian aviators will be sent to France for instruction and French instructors will go to Russia. Since the beginning of the war, continues the editorial comment, France has furnished her Allies with one fifth of her output of aeroplanes and one third of the motors she has produced.

Aircraft Bombs Mentioned in Ordnance Report.— Among the interesting items mentioned in the annual report of Rear Admiral Strauss, chief of the Bureau of Ordnance of the Navy Department, is the manufacture of bombs for use by aircraft. It is stated in the report that these have proved satisfactory in tests and that more will be manufactured. Another interesting item is that relating to a one-pounder gun which has been developed by the Bureau for use on aeroplanes. Plans are under way for increasing the calibre of this gun. There is now being manufactured a large number of 3-inch anti-aircraft guns for use on all battleships, while designs have been made for a similar type of 4-inch calibre.

Equipment of German Aircraft.—Details regarding a Teuton hydro-aeroplane which fell into the hands of the Russians in the Riga region are of unusual interest in that they disclose the thoroughness with which German aircraft are finished and equipped. To quote from the report of the *Morning Post* correspondent at Petrograd: "All the necessary manipulating parts of the machinery are made luminous at night with a radium composition. There is a special newly invented level to facilitate handling the 'plane in darkness, and a special compass, and seats are provided for three. The hydro-aeroplane carries a searchlight, a Maxim, and a rifle, with an adequate supply of ammunition, and ten bombs, five on each side, of ten pounds weight apiece."

Huge American-Built Battleplanes for Allies.— It is announced by the officials of an American aeroplane manufacturing company that orders have been placed by the Allied governments for 11 huge battleplanes of most modern design. Each aeroplane will weigh in the neighborhood of 30,000 pounds, and the frame work will be entirely of steel. It is said that the wing spread is to be 180 feet, while the length of the aeroplane from tail to propellers will be 104 feet. The framework will be constructed on the cantilever truss principle, insuring great strength with a minimum weight. Twin bodies will be used, each body carrying an engine of 800 horse-power. It is planned to arm the machines with four guns, two fore and two aft, of a calibre of between 1½ and 2 inches, and capable of firing 20 to 40 shots per minute. Each airship will carry a number of bombs of any size up to 14 inches in diameter. The specifications call for a speed of 85 miles an hour with full load and a crew of six men.

New Compressed-Air Motor for Model Planes.— Although miniature motors operated by compressed air are not a novelty in the field of model flying machines, still a new type which has just made its appearance is sufficiently different from the others to command passing comment. It is a five-cylinder rotary type and weighs but four ounces with propelier and mounting frame. On 15 pounds pressure the motor will turn over at 1,000 r. p. m. The bore of the cylinders is 11/32 inch and the stroke 7/16 inch. The "overhand" method is used in mounting the motor on model aeroplanes. With the exception of the valve springs, the entire motor, mounting frame and tank are made of brass.

Science

Electrolysis Mitigation forms the subject of an important publication of the U. S. Bureau of Standards, issued as Technologic Paper No. 52. It discusses in detail the various methods of electrolysis mitigation heretofore tried or proposed for protecting underground structures; these being treated under two heads, *viz.*, pipes and the railway return system. Regulatory and legal aspects of the subject are also discussed.

Radio Stations of the United States.—The Bureau of Navigation, Department of Commerce, has recently issued the 1915 edition of "Radio Stations of the United States." This list shows that there are now 5,073 radio stations in the United States, an increase of 1,139 since 1914. They are classified as follows: Government and commercial land stations, 224; Government and commercial ship stations, 895; special land stations, 118; general and restricted amateur stations, 3,836.

Rabies.—A case of rabies reported in England last spring was the first in that country since 1902, and occurred in a dog that was being held in the six months' quarantine which the English law imposes on all dogs brought into the country to prevent the introduction of this disease. Rabies was banished from England by muzzling. Australia and New Zealand have never had any cases of rabies, and a system of quarantine and inspection prevents its introduction. Sweden, Norway and Denmark are practically free from it.

Coast and Geodetic Survey Publications.—We recently called attention to the plan adopted by the U. S. Geological Survey of displaying and selling copies of the Topographic Atlas sheets at post offices. It is now announced that the Coast and Geodetic Survey will display in the post office of each important seaport in the United States a copy of the principal local coast chart which it publishes, together with information as to how its charts and other publications may be obtained. These include sailing charts, general charts of the coast, harbor charts, tide tables, coast pilots, notices to mariners, and miscellaneous scientific publications.

Elster and Geitel.—A large number of scientific men in Germany and Austria have united in publishing a "Festschrift" in honor of the sixtieth birthdays of Julius Elster and Hans Geitel, which occurred December 24th, 1914, and July 16th, 1915, respectively. These two men, one a lecturer and the other a professor of physics and mathematics at the gymnasium in Wolfenbüttel, furnish an almost unique example of collaboration in scientific investigation and writing so intimate that the names of the collaborators are rarely mentioned separately. Except in the minds of their personal acquaintances, "Elster and Geitel" constitute a single personality, and a very prominent one, in the realm of the new physics. They have been pioneers in the investigation of radioactivity, ionization and kindred subjects. The "Festschrift" above mentioned comprises a collection of original memoirs by the numerous contributors.

The Activity of Lassen Peak—the only active volcano in the United States—appears to have reached its culmination on May 21, when violent explosive eruptions occurred and "flames" were said for the first time to have issued from the summit of the peak. This eruption caused Hat Creek, a stream on the north side of the mountain, to overflow its banks and sweep down over its entire flood plain a vast sheet of mud and water. Adjacent farms were buried in from 1 to 3 feet of mud. Ashes from the explosions were carried eastward more than 200 miles. The outburst is said to have been preceded by an earthquake. Since that date the volcano has subsided, and by the end of September it had nearly ceased its activity. A small eruption was observed as late as August 6th, and a pillar of smoke arose from the summit September 9th and 23rd.

An Experimental Study of Pellagra.—Drs. Goldberger and Wheeler, of the U. S. Public Health Service, have just reported the results of a most interesting experimental investigation of pellagra, carried out at the farm of the Mississippi State Penitentiary. A volunteer squad of 12 white male convicts from 24 to 50 years of age was organized, and these men submitted themselves to experiment, under the incentive of an offer of pardon from the Governor, together with assurance of proper care and treatment if needed. There was no history of the occurrence of pellagra on the farm, and from the beginning of the experiment the squad was strictly segregated and under guard day and night. One man was disqualified in the course of the experiment. The rest remained under observation from the beginning of February to the end of October, 1915. Until April 19th they were kept on the ordinary prison diet, and no evidence of pellagra was detected. Thereafter they were kept on a restricted, one-sided, mainly carbohydrate (cereal) diet. Of the 11 volunteers, no less than six developed symptoms, including a "typical" dermatitis, justifying a diagnosis of pellagra. No other person on the farm presented evidence justifying even a suspicion of the disease.

Inventions

Phonograph Records on a Paper Base.—Thomas A. Edison has recently been awarded a patent on a process of making phonograph records of a composition consisting mainly of diphenylamin and shellac, with the addition of some minor ingredients. This is said to be not only harder and more durable than the compound now made use of, but also permits of the manufacture of these records on a base of paper, making possible a material reduction in the cost of their production. Mr. Edison has also been granted a patent on an improved mounting for a reproducer carrying a stylus instead of a needle. There has been some difficulty heretofore experienced in making the stylus point follow the groove of the record, but this trouble is said to have been overcome by the new form of mounting. The stylus used in this case is a polished diamond.

Air Method of Measuring Hides.—A new German process just patented in this country for measuring the area of hides, makes use of a pneumatic method instead of the mechanical methods which have heretofore been in vogue. It is claimed for the pneumatic process that it is quicker and more accurate than anything that has yet been devised. A table top mounted on a funnel base has many perforations of equal size, placed at regular intervals. A suction fan draws its supply through these holes, and the skin to be measured being placed upon this table, causes a reduction of the air current cross section. Thus a rarification of the air with a resultant measurable sub-pressure is created which serves for a calculation of the area of the hide which is resting on the perforated plate. This figure is indicated by the combined readings of a vacuum gage and the tachometer arranged together at a convenient point over the table.

Prevents the Fireman's Death Plunge.—A common form of railroad accident is that which often takes place when, by some accident to the coupling between them, the tender and the locomotive become separated. In such cases the air brakes are automatically applied and the runaway train brought to a stop. But if the fireman is at his post on the tender, the sudden application of the brakes is sufficient to throw him off his feet, and he is hurled headlong under the wheels of his own train which has not yet been brought to a complete standstill. Matthew J. Slattery and Charles A. Diehm, two railroad men of Philadelphia, have been recently awarded a patent on a device which is designed to save the fireman's life in this emergency. The apparatus consists of a metal net, carried beneath the floor of the tender, which, in case of a parting between the locomotive and tender, will be released and drawn forward to provide a safety net to catch any one who may be standing on the tender at the time of the accident.

Bird Houses Made of Clay.—Harris M. Benedict, of Cincinnati, Ohio, who has achieved a wide reputation as the result of his endeavors to work up a sentiment in favor of protection for wild birds, has been recently granted a patent on a bird box which has a number of novel and interesting features. In the first place it is of a deep pitcher-like shape and made of fire clay which can be readily shaped while in the plastic form. The surface may be made to simulate the bark of the tree. The bark-like finish makes it particularly desirable for the birds, as these feathered visitors are known to avoid anything in the way of a home that is too conspicuous. This bird box has the usual exit and entrance orifice near the top, with a raised waving line inside by which the little birds may help themselves to the entrance when this assistance is required. Another novel feature is the sloping lid with an overhang to protect the interior from being flooded by storm, as well as a deep flange to prevent it from being dislodged by the wind. By means of this lid the bird lover may watch the progress of his tiny charges.

Double-Bladed Hack Saw.— The capacity and speed of the power-driven hack saw has been doubled by a saw which has two blades, each one attacking the work from opposite sides, thus doubling the capacity of the ordinary single bladed machine. It is said to be possible to get 270 strokes per minute with this apparatus. The blades move up and down in unison, one cutting on the down stroke and the other on the up. The sawing is thus a continuous operation; both saws feeding into the stock and releasing on the return. The device makes use of standard hack saw blades and by reversing them it is possible to secure full service from them. The saw frames are of heavy seamless tubing and are operated in the usual manner, but a novel feature is introduced in the method of keeping the work and blades cool without the use of a pump. The lower ends of the frames have ball check valves which work up and down in the cooling solution contained in the base of the machine, thus forcing the cooling liquid through the tubing and down on the saws. This system of circulating the cooling liquid appears as efficient as it is simple.

Woman worker engaged in cementing the metal caps and fastening the water reservoirs in place on the otherwise finished tubes

Highly skilled glass blowers at work forming the X-ray bulbs and sealing in place the metal members

Making of X-Ray Tubes in War Time

How the Unparalleled Demand for Tubes Was Met by French Manufacturers

By Jacques Boyer

THAT preparedness for war means more than the training and arming of men is now common knowledge; but the extent to which a nation is obliged to meet internal and industrial situations which were not foreseen is difficult to imagine. In the accompanying article, Jacques Boyer tells how France succeeded in meeting the exigencies of what promised to be a most serious situation, by making her own X-ray tubes. The story is interesting not only for its scientific value, but also for the lesson in industrial preparedness which it teaches.—EDITOR.

For years past France had been equipping the sanitary corps of her army with X-ray outfits. She believed this phase of her *materiél* ample in taking care of all her wounded in any war she might engage in. Yet the opening days of the European war found her inadequately provided with X-ray plants: the nation was suddenly confronted with the problem of equipping many times the number of her original plants, for the magnitude of the great war exceeded all expectations and preparations. But the problem has since been solved. To-day, France not only supplies all her needs as regards X-ray tubes, but she also is supplying those of her allies.

In an X-ray equipment the most important member is the tube. Prior to the war there were only two firms engaged in the manufacture of X-ray tubes in France; one of these contented itself with the making of small tubes suitable for experiments and school demonstrations, but not for practical work; the other, while in a position to compete with the largest firm in Germany specializing in X-ray tubes, concerned itself mostly with other products. In no wise did the two firms possess the facilities for turning out the vast number of tubes suddenly required by the sanitary corps of the French army.

Near the end of August, 1914, the military administration of France, forced to immediate action by the pressing need, requisitioned 400 X-ray tubes that happened to form part of the stock of one of the manufacturers, at that time. But the tubes seized failed to prove sufficient in the face of the continually increasing number of wounded. It became necessary to restore the French ante-bellum X-ray tube factories to their usual activity —at the time they were in a disorganized state owing to the mobilization of the men into the army. The technical personnel was recalled from the front and assigned to the task of not only restoring the X-ray tube industry, but also of developing it on a far greater scale than ever before.

Meanwhile the Appert brothers of Glichy, aided by M. Matignon, professor at the Collège de France, and M. H. Pilon succeeded in providing the high grade glass which German glass blowers for years had been importing from France in the crude state and claiming as their own product in the finished glassware. Before the middle of November, 1914, the glass makers were in a position to furnish the raw materials required by the tube manufacturers. There then followed the rapid upbuilding of the revived and greatly enlarged industry.

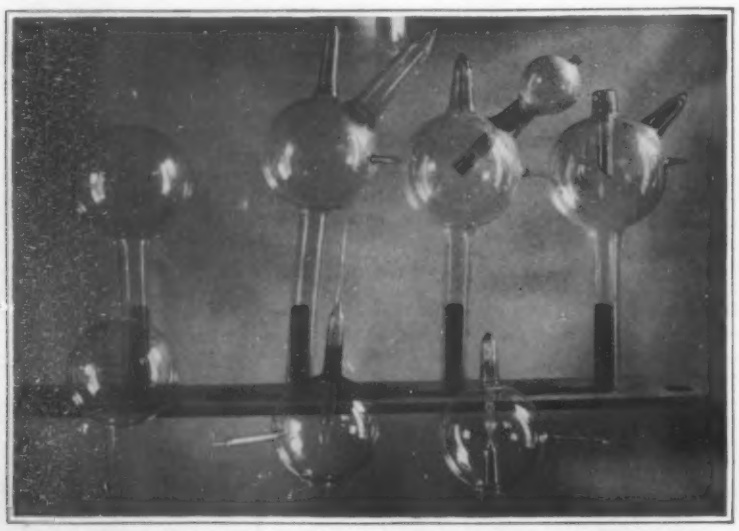
Pump room where the air is exhausted from the X-ray bulbs

The manufacturing of X-ray tubes calls for a high degree of skill on the part of the workers. There are numerous steps in the work before the complete tube results, and each tube is subjected to a great number of tests at different stages in its construction as well as upon its completion, so as to ensure perfect results to the ultimate user. There follows a brief description of the manufacture of these tubes in one of the French factories.

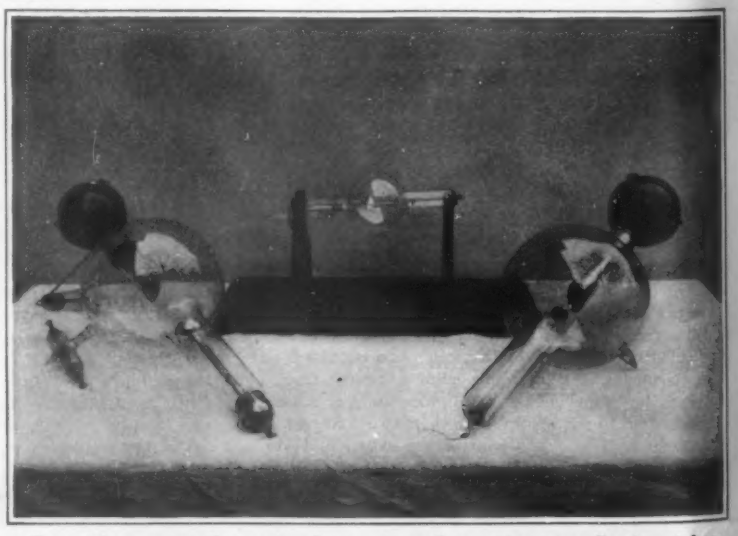
For the sake of convenience, the making of the metallic members is considered first. The cathode, which is made of pure aluminum, is machined in the form of a concave mirror, and facing it in the finished tube are the anode and anti-cathode. In many of the French tubes tungsten has been adopted for the reflector, which forms part of the anti-cathode, because of its high melting point. As the copper portion of the latter member heats at the same time as the tungsten reflector, it is provided with heat radiators and a water reservoir for cooling purposes. The anti-cathode is made by cutting a copper bar of the desired diameter into pieces of suitable length. These are machined so that the tungsten reflector can be placed in the center of one end, after which the entire piece is heat-treated in a gas furnace and subsequently subjected to compression in a powerful hydraulic press. As a result of the compression, the two metals are closely joined together and the copper becomes more homogeneous. It should here be stated that the tungsten reflector is carefully adjusted and subsequently soldered after the heat treatment and before the compression. The anti-cathode is then turned in a lathe to the desired diameter and drilled longitudinally, so that it can receive later the tube which serves to connect it with the water reservoir. On the shoulder of the piece there is soldered a collar of platinum, which permits that member to be united ultimately with the glass in the sealing-in process.

The next step is the mounting of the anti-cathode on

(*Concluded on page* 110)



Glass bulbs for different types of X-ray tubes at various stages in their blowing and in the sealing-in of electrodes



X-ray tubes representing past and present practice: center, an earlier type tube; right, Coolidge-Pilon 1915 type; left, Pilon O. M. type

Simple Food Tests

Experiments by Which Adulterants May be Detected

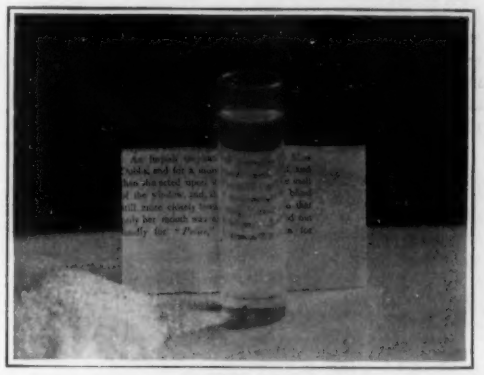
By S. Leonard Bastin

A VERY good test by means of which the best fresh butter may be distinguished from the made-up article or margarine is that in which a small quantity of the sample is placed in a tiny tube. This is set in water sufficiently warm to melt the contents; the sample is kept in a melted state for half an hour and it is then examined. If the butter is pure, and of the highest quality, it will almost certainly be clear. On the other hand with margarine or a worked-up butter a certain cloudiness will be apparent. A more simple, but equally reliable test, is that in which a piece of the suspected article about the size of the tip of the little finger is placed in a spoon. This is held over a gas burner, and the behavior of the sample is watched. Real butter boils quietly, producing a quantity of small bubbles; on the other hand margarine, or a process butter, will crackle and sputter much in the way that green leaves do when they are placed on a fire.

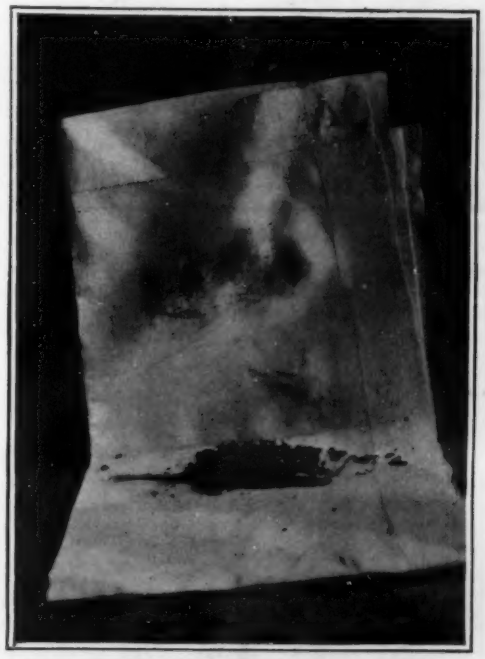
Two simple tests for tea and sugar are indicated. One of the commonest adulterations of tea is the dyeing of the leaves to make them look a good color. The fraud is very easy to detect. Get a clean white cloth and rub some of the dry leaves between the material. Pure tea which has not been treated should leave no mark on the cloth; dyed tea will make a very definite stain that will not easily be rubbed away.

Several additions are now and again made to sugar and, without an elaborate analysis, it is not easy to determine the exact nature of these. As a rule pure sugar should answer the following test satisfactorily. Make an almost saturated solution of sugar and water; place this in a glass tube; then stand in front of some print. It should be possible to read the type quite clearly through the sugar solution. In the case of brown or raw sugars there might be a certain amount of discoloration of the water, though any turbidness is almost certainly an indication of adulteration.

An unscrupulous baker will work into his bread as much salt as possible. Experts say that an increasingly large amount of salt may be put into bread without the consumer's being aware of it. The idea is that bread loaded with salt weighs more heavily on account of the moisture which it will retain. To find out the real value of bread from the standpoint of weight a little experiment may be followed. Take two samples of equal weight, and bake these in an oven for an hour. At the end of this time weigh again. That which is the heavier is the better value. The addition of alum to bread to make it white (often used to mask an inferior flour) is much to be condemned. Small quantities of alum taken regularly in this way are very harmful. Happily a simple test for the discovery of alum in bread is available. Take a sample of the suspected article and place it in a saucer. Then pour over it a solution of carbonate of ammonia. If alum is present in the bread it will turn black, but if the bread is pure no change will take place.



Pure sugar when dissolved in water should be so transparent that ordinary newspaper print can be read through it



Dry tea leaves rubbed in a white cloth, will leave a stain if the tea has been "doctored;" if not, the cloth will show no color

A large amount of jam is dyed; brightly colored articles should always be suspected. The point may be definitely established in this way. Mix a sample of the jam or jelly with an equal quantity of water. Throw into the mixture a piece of cotton wool and boil for half an hour. Now try to wash out the stain. If the jam is pure the stain can be easily removed; where dye has been used no amount of washing will get rid of the stain.

Finally a good test for vinegar may be described. In this case a common adulteration is the addition of some mineral acid. The presence of the harmful article is readily disclosed. Take a sample of the vinegar and add a few drops of methyl aniline violet. Pure vinegar shows no alteration, but the adulterated sample turns a blue or a green color.

The Current Supplement

THE article on *The Improvement of High Boiling Petroleum Oils by the Action of Aluminum Chloride*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, for January 21st, is of considerable technical value in view of the increasing price of gasoline. It contains tables of tests of a number of oils from different sources. *The Waterpowers of Canada* summarizes the facts relating to a number of power possibilities, some of which are under development, and there are a number of excellent illustrations. An interesting diagrammatical sketch illustrates *Trenching and Mining Operations*, as carried on at the battle front in France. *How Trees Heal Their Wounds* describes the provisions made by nature for self-healing of injuries, a subject suggested by the spectacle of trees in the war regions of Europe that have suffered from shell and machine gun fire. *Leather Investigations* gives many facts relating to the manufacture of shoe leather that are of importance to everyone. *Bacteriology of Wounds in War* treats of a subject of extreme importance, and of the complicated conditions of the special case. There is another article on *Metastability of Metals*, supplementing one recently published. *The Largest Gasoline Ferryboat* describes and illustrates a craft unique in many ways that is successfully operated by ordinary gasoline instead of a heavy oil, as is the usual practice in vessels of large size. *Washing Locomotive Smoke* tells how the nuisance created by a railroad engine house in a populous district was abated. *The Control and Protecting of Electric Systems* is an interesting story of the marvelous growth in the development of electric power, and some of the problems that accompanied it. The merits of *Cast Iron as a Material for Explosive Shells* is discussed in a short article. *Tortoise Shell Divination* is another of the shorter articles of interest.

Pure butter boils quietly, artificial butter or margarine sputters and crackles

Methyl aniline violet turns adulterated vinegar blue or green

The better bread is heavier after the moisture has been baked out

Dyed jam will make a stain in cotton that will not wash out after the cotton has been boiled

Bread containing alum will turn black when treated with carbonate of ammonia

Pure melted butter is transparent, artificial butter is cloudy

Strategic Moves of the War, January 13th, 1916

By Our Military Expert

ASIDE from the strong German attack which occurred in the Champaign sector during the second week of January, and which was thrust back by the French counter movement, attention still centers upon Bukowina and the Czernowitz district, where the Russian offensive continues its efforts to oust the Teutonic right from its position.

Considerable interest attaches to the Mesopotamia campaign, which, although not of the character of major operations, has a considerable political bearing upon the Balkan situation and that of India.

The western line seems immovable as ever during the past months; the eastern line, from Riga to the Pripet marshes remains inactive; the first Serbian campaign has been brought to a close by the clearing of the district, while the Entente allies are gathering strength at Saloniki behind lines which are reported as steadily becoming approximately impregnable. The situation at the Grecian city powerfully suggests the lines of Torres Vedras, behind which Wellington prepared for a drive in the Peninsula campaign—which eventually resulted in a Waterloo a few years later.

The map showing the left of the Russian line may well be of interest as it shows clearly the probable objective of the Russian offensive.

Czernowitz is merely an incident in the campaign, which must be overcome before it can be prosecuted to a measure of success. A direct drive upon this city is hardly needed to secure its possession; a cutting of the railway line to Kolomea, which is threatened by the bend of Russ force in its vicinity, would almost immediately necessitate the evacuation of Czernowitz, and such an attempt may well be expected.

The object of the drive must be the Halicz-Stanislau-Kolomea line, three railway centers of importance, the connecting territory of which lies almost entirely south of the Dniester. According to the latest reports, the Russian position is nowhere more than 30 English miles distant from this important line. These three towns are all Teutonic bases at the present time; the information that the Czernowitz base has been shifted to Kolomea is doubtless true, as a glance at the Russian position which threatens the railway will show. Possession of Stanislau by the Russians would at once sever the lateral communications so important to extensive operations and the shuttling of forces from point to point. It is, therefore, the most important objective of the line.

It is rather evident, upon analysis of dispatches from other Teutonic fields of action, that all available Austrian troops have been shifted to this locality with the exception of those engaged in Montenegro, and the character of the country lends itself so well to defensive operations, that it is highly problematical whether even rejuvenated Russia can successfully force through, even at a tremendous cost in life. The greatest possibility of success lies in activity on another front which may necessitate the holding of reinforcing troops or require a weakening of the Bukowina line—which is rather improbable—to meet.

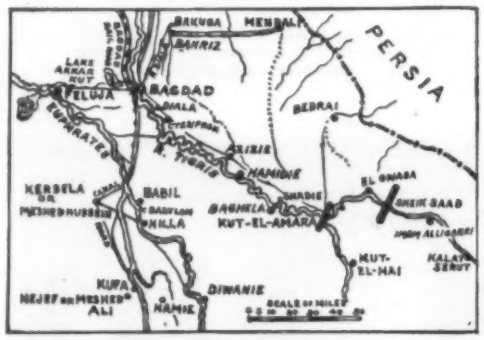
The destination of the forces withdrawn from Gallipoli enters into the question. There are several points to which these troops, estimated at some 200,000 strong, may be sent, namely, the western line, where a stupendous attempt to break the German line would insist upon the recall of Teuton forces elsewhere; to Mesopotamia, that a probability of prompt control of the section would be engendered; to the defense of the Suez Canal section, which reports from Teutonia say is to be attacked in force; or to Saloniki, in preparation for an offensive return through the Balkans.

The lot of the prognosticator is an unenviable one, yet the rôle must be assumed at times, under protection of the law of probabilities. From the newly awakened Russian activity, then, it seems probable that at least a good portion of Entente strength from Gallipoli will find its way to Saloniki, as action from this point would more nearly supplement Russia's efforts than from anywhere else.

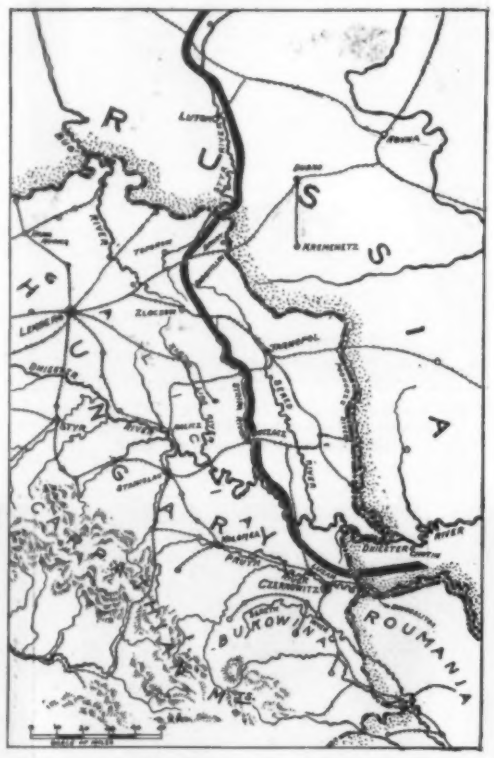
From where the Russian line touches the border of Roumania, it extends westward by north, practically paralleling the railway from Nowoselica to Luzan, although whether it is 5 miles away or 15 it is impossible to say, from the meager exactness of dispatches. It is sufficiently close, however, to establish a very real threat to not only Czernowitz, but its communications. From this point, the line bends northward, striking the Stripa near its junction with the Dniester. Reports state that the Stripa is held by the Russians from Buczacz to the vicinity of Zloczow, to the northwest of Tarnopol. Beyond this point, the line sags westward in the direction of Toporow, on the Styr, following the line of this river to the eastward, around Lutsk, where it again springs forward to the river to the northward.

It is impossible to exactly locate the line, for ample information is not vouchsafed by the Russian censorship; and for such a general article as this, the approximate position with relation to important junctions and rivers is sufficient for the understanding of the general situation. In any event, future developments will be rather dependent upon operations elsewhere in Europe.

The operations in Mesopotamia date from the early part of April. At that time a mixed British army corps in which were many Indian troops undertook protection of the great oil wells near the head of the Persian Gulf. Columns were then dispatched up the Euphrates and the Tigris, moving upon Baghdad. Late in November the forces arrived within striking distance of Baghdad, after having fought a hard fight against the Turks and local conditions. Water was scarce and as the city was



British operations on the Tigris



The Russian offensive in Galicia

neared, the Turkish forces became too numerous for the slender column to successfully cope with and retirement became necessary.

During the retreat, a force numbering about 10,000 was detached at Kut-El-Amara, at the junction of the Tigris and the Shat, and left to hold the place while the main forces continued their retreat.

During December, the Turks, rejoicing in the defeat of the British column gathered in considerable strength in the vicinity of Kut-El-Amara and succeeded in surrounding the detachment.

A British force left Imam-Alligarbi early in January to attempt relief of the Kut position, marching by the south bank of the Tigris. At Sheik Saad the Turkish forces were encountered and those on the north bank were pushed back with comparative ease, while the main British column engaged to the southward, where, it is reported, the Turkish forces were compelled to retire, being pursued by the British.

This British Mesopotamia campaign has been the subject of much adverse criticism abroad. In the first place, claim is made that the force sent into the movement was inadequate to accomplish the desired results and that, even if it had been possible for the expedition to cut its way through to Baghdad, sufficient strength would not have been available for effective control of the section. It is, therefore, not at all improbable that a portion of the troops released by the withdrawal from Gallipoli will soon be actively engaged in Mesopotamia.

It is scarcely to be expected that much of the Turkish force released from the Dardanelles will be sent into Mesopotamia, as it is believed that ample Teutonic forces are already in the section to offset whatever Entente troops may be present. It is, however, not entirely unreasonable to suppose that at least a demonstration may be made against Egypt, as has been predicted by the Teuton press for many weeks, if for no other purpose than that of holding the newly faced Entente troops close to their present location.

Main interest will probably continue to lie with the Russian front. Not only is a general retirement of German advance base reported on the south of the line, but from the north as well, although there now appears no very real threat of menace on the Riga sector. How far the present offensive movement in the south will be extended throughout the line is hard to say. To adequately man a line requires something like 7,000 men per mile of front; on a battle line 800 miles in length—the approximate contact length of the existing eastern line—5,600,000 men should be necessary. But for purposes of offensive movement, this strength must be at least trebled locally, that casualties may be easily replaced, momentum secured for the advance and sufficient troops be left after the climax of assault to hold the position.

The front of Russian activity in the south is about 250 miles in length—say 200 miles for that part actually supposed to be under advance. If the proportion of available men for attack is but 14,000 per mile, almost 3,000,000 men are necessary for an adequate movement; and it is seriously to be doubted whether such a number is engaged on the Russian side. If they are there, they have almost certainly been taken from another part of the line.

The Germans have a way most disconcerting to their enemies, of breaking out in fresh places. The Teutonic intelligence service is more complete than that of any other country and, it is reported, finds its greatest amplification in Russia. It is then highly improbable that Germany does not know definitely where these troops have been taken from.

Basing the conclusion upon past performances, it is believed that a strong Teutonic offensive is about due for launching somewhere north of Pripet. The section between the Niemen and Vilna seems to offer an enticing ground, for the divergent railways from Grodno as a base, form two radiants of supply and the main line of the railway which furnishes the lateral communications for the Russian front constitutes a prize well worth striving to secure.

It need occasion no surprise, then, if this section becomes the scene of great activity in the near future, unless the Entente allies strike beforehand in some now unknown quarter.

Eating Raw Food

COMMENTING on the recent "raw food" school, Dr. Toulouse, a French physician, points out some of the advantages and drawbacks of the idea of consuming all food raw. Naturally in our common practice this is often done and even in the case of animal flesh such as oysters, dried beef, and others, and such substances are well digested, even better, it is claimed, than cooked meat. Salads, radishes and all fruits are eaten raw, and while they cause more work to the digestive organs by the character of the cellulose under such conditions, on the other hand they afford ferments which greatly aid in digestion. Comparing the two systems, cooked or raw, the latter is the most essential for preserving life, for when the system is deprived of all fresh food, diseases of the scorbutic type appear, especially in children. The only drawback with raw food is that it may bring disease germs, which cooking destroys, and this consideration above recommends cooking in numerous cases. However an important point is that certain aliments are quite indigestible, even though the most nutritious, *i. e.*, dried vegetables such as beans and peas, and even the most convinced of the new vegetarian school could not consume these. In the foregoing the question of taste was not considered, but in fact, cooking develops a flavor which aids in the secretion of digestive substances, and hence it is not a simple question of enjoyment of food. The practice of eating raw food does not therefore appear to be justified beyond the point where it is already the customary practice.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Our Future Naval Policy

To the Editor of the SCIENTIFIC AMERICAN:

After 18 months of the greatest war in history, Great Britain has shown by her navy that sea supremacy is absolutely vital for a successful carrying on of a gigantic campaign—she has also shown that by secret treaties, she undertook to keep the seas open while other strong military nations provided the fighting forces. It is almost unbelievable that after all the lessons that we have learned in the past few months that no definite steps have been taken to immediately commence and make good the weak places in our Navy. It must be borne in mind that the United States of America is really in a more perilous position than England. We have an immense sea coast connected by a canal that in time of war would be in danger of destruction at a vital point, which would at once divide our Navy. Seeing that we do not wish to make any alliances with Europe or Asia we must always make the allowance of being attacked by a combination of powers. I see it advocated that by 1925 our Navy should be as strong as any two powers except England. Now if England in all her shipbuilding policies had made the same rule she would be in a different position to-day. For instance, if England had said, we will always have as strong a navy as France and Japan, and not count Germany, where would she be to-day? Seeing how treaties are almost worthless when the actual trouble is imminent, does it not behoove us to have a navy equal to England's. Does the average man know how many miles of sea coast we have, to say nothing of our distant possessions, of a possible hostile continent to the north and another one to the south only waiting to fly at our throats when the proper time arrives? We must look at it from the point of view of a nation, absolutely alone, with no defensive alliances, and liable to attack on both coasts. There seems to be some attempt to make an alliance with the South American Republics. Again let us look at the geography. The strongest countries, namely, Argentine, Brazil and Chili, are the farthest away. None of these countries has a very large navy and in case we were attacked by any European combination the South Americans would probably decide that the place for their own navies was at home—also at present none of these Republics are in a financial position to start out on a big navy program. So it just remains for ourselves to take note of the lessons that are being learned in the present conflict and if possible see to it, and correct some of the mistakes and not be found short when the time comes. Why cannot the people put full faith and confidence in the Navy Board and immediately vote the money without a quibble or dissenting vote and start now at once to put our navy where it should be? I remember several years ago making a trip down the River Clyde from Glasgow to the sea, and both sides of that little crooked river were simply lined with shipbuilding yards capable of building anything from the "Lusitania" to a "dreadnought." These were all private yards and in almost every yard there was a warship of some kind in course of construction and I distinctly remember at one yard in Greenock two large battleships on the slips, one cruiser being finished fitting out and three 10,000-ton passenger steamers for South American trade—and all this is only one instance of private enterprise with government help. Now at the present time we are in a better position to build a navy than ever before in the history of the country. All our shipyards are working overtime on orders for cargo ships and all the machine shops connected with the yards are in good shape. So why cannot these same yards be encouraged to bid on navy work with a prospect of continued orders instead of the yards drifting back to their old pre-war stage? It must be remembered that when the war is over there will be a feverish activity in European countries for the building of all classes of shipping, both mercantile and naval, and we shall have to meet this combination. To show what a low ebb our mercantile marine had reached before the war: Our only transatlantic line from New York to Europe had no longer catered for first-class passengers. Now that shippers and the people in general see our weakness in the scarcity of American cargo steamers, could not something be done at once by Congress to vote a subsidy for every ton of export carried in American bottoms? If something is not done right off to protect this ship industry we shall never be able to meet the cut-throat competition that is coming. Does the average man know the history of American shipping on the Pacific Coast? If not, it ought to be brought out in bulletin form and given to every voter in the country. What is the percentage of American seamen on American ships trading out of our ports? It is ridiculously small: The engine room and deck officers being Americans, the stokers and deckhands are made up of all nationalities. Now Germany and Great Britain have their large passenger and cargo steamers in every corner of the globe and almost all the officers and in many cases the engine-room staff are naval reserve men, who in time of war are capable of being transferred immediately on to transports, home defense ships, mine sweepers, etc. Where are we in time of war going to get the trained men to replace the lives lost in the sinking of, suppose, two dreadnoughts? The making of a naval seaman is becoming more and more of a problem every year, and once having picked out the most intelligent and useful men and trained them, why not have them in naval reserve? A few months ago the old revenue cutter "Woodbury" was sold out of the navy for a song and destroyed. Now how much more useful she could have been lying anchored in any coast seaport as a training school ship for boys. Every State has its reformatory schools. Why not have the Government loan one of those old ships to each section having a port and use them for training and fitting these boys for a seafaring life? We have plenty of farmers, but it takes years to make a good sailor and we have in the majority of these boys the foundation of an excellent lot of sailors and by the time they are 18 to 20 years of age they would be invaluable as seamen on both the naval and mercantile ships of the country. I would also advocate a very vigorous advertising policy to reach the rural districts where, as a rule, a very large number of the best young men are drifting to towns at an age when they would be most easily trained and would make good, rugged sailors. There is no sailor in the world better paid and better fed than the American sailor, and the chances of advancement are very good to anyone who puts his best into the life and pushes ahead. Why not have a special corps of moving picture films to tour all the smallest towns and give a free show of life in the navy—and have the advantages, the pay, and the inducements offered by the navy posted in every post office in the Union, instead of in only the principal post offices of the State, and also have a working agreement between the recruiting officers of the navy and the heads of our own steamship lines, so that in case a man is not eligible for the navy on account of some very small defect he could be found a position in the mercantile marine? By the man's actions of attempting to join the navy is shown that he desires a seafaring life, so why lose track of him altogether when he is still fit for the upbuilding of our merchant fleet? I have seen it quoted that we have at present all the naval sailors necessary, but if our shipbuilding program is carried out we want to start at once on a policy of making the naval and mercantile marine known to all our young men as a patriotic, healthy, and prosperous life. Every year we see thousands of our young men going through high schools and graduating. What has been done to interest them, the most inteligent in the country, to adopt the sea as a profession and once more get the Stars and Stripes seen in every sea?

Sebago Lake, Maine. PATRIOTIC.

How a Rifle Is Sighted

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of Dec. 11th there is an article headed "How a Rifle is Sighted" which, while very accurately describing the sights on the various military rifles, gives such a curious description as to how one sights a rifle, in aiming, that I feel I must answer it.

The writer of this article says: "Normally the shooter sees the rear sight sharply for an instant, as he draws the front sight into the notch, then, trying to hold the front sight into the notch, then trying to hold the front sight in its correct position, he focuses on the mark. By that time the rear sight is very blurry and fuzzy, because the eye is not in focus for something 15 inches away, but for the infinity of distance."

Now I have shot all my life, and often I have to shoot to save my skin, when shooting dangerous game, and I have never had the things happen to me described above.

The rear sight never "appears blurry or fuzzy" to me, nor do I "see the rear sight sharply for an instant" and then try to do the same on the front sight, nor do I hunt for the object I want to hit by moving the front sight about.

What I do, and I think all big game shooters will agree with me, is to entirely ignore the hind sight. I look at the spot on the object I want to hit, (or, if it is moving, at an imaginary spot the right distance in front of it), bring up the rifle and as it touches my shoulder, the front sight is on the spot I want it, the front sight is just right in the middle of the notch of the rear sight and the rifle goes off.

The whole of this process takes place instantly and mechanically. I have my aiming eye focussed on the object I want to hit all the time. I never try to get a clear view of the hind sight, any more than a man with a shot gun does. I look at the object and the rifle comes up aimed correctly.

I remember when typewriters first were introduced the same idea of not being able to focus the eyes rapidly in searching for each letter and then striking it, was thought to be very bad for the eyes, but a writer on the machine can shut his eyes and type with accuracy.

The moment a man begins to hunt for his sights he is no use for practical shooting at rapidly moving objects, although he may be able to hit a stationary target when he has unlimited time to focus his eyes on various objects and then begin to hunt about with the end of his rifle, and then think about squeezing the trigger.

I find the peep sight no use in the dusk of the evening or early dawn, when most of one's shots are taken, also in a thick wood the peep sight is useless.

For extreme accuracy, where there is time to take a stationary aim, the telescope is far in advance of any peep sight, but the open sights are the only practical ones for game shooting and in consequence, I should imagine, for military purposes, when the object is moving. WALTER WINANS,

Olympic Games of 1908 Champion Hunting Rifle Shot.

London, England.

Submarines vs. Battleships

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Roger L. Gordon in a letter to you published Jan. 8th in your correspondence column states about submarines: "They are worthless, practically, for defense. If the enemy, through the weakness of our battle fleet, secures control of the sea, he will, as at the Dardanelles, take measures to neutralize them."

The Allies believed there were no submarines at the Dardanelles and quoting from their own words, "They hoped to do something before the pests arrived." One of the pests arrived and accounted for two battle ships. There are many of the pests near the Dardanelles now and the Dardanelles campaign is a failure.

Why have not the English dreadnoughts entered the Baltic? Because they feared the German submarine.

In my opinion the submarine is ideal for defense.

Now for the offensive.

The English submarine has entered the Baltic, where the dreadnought dared not go. Much damage was done there by the English submarines.

The French and English submarines have entered the Sea of Marmora where the dreadnoughts could not go.

Except in the Baltic no German or Austrian ship has been 50 miles from a friendly port except the submarines.

I believe no dreadnought of the present design can operate near a hostile port, if that port has submarines.

The Allies control the sea. One reason for that is that they have two or three times as many battle ships as the Central Powers. But the chief reason is that they have ports all over the world and the comparatively few ports of the Central Powers are shut in. Ships from those ports can not get to the open sea without passing the ports of the Allies.

I congratulate the Administration in casting off the cobwebs and asking for 85 const defense and 15 fleet submarines.

F. A. de PEYSTER.

New York.

Tide Power

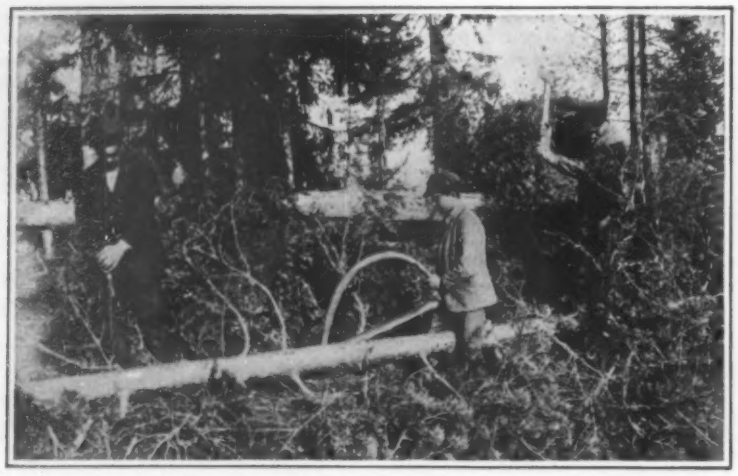
To the Editor of the SCIENTIFIC AMERICAN:

In the article entitled Future Possibilities of Electricity (Dec. 4, page 490) the author writing of the inherent difficulties of utilizing the energy of the rotation of the earth refers to the energy of the tides as "largely moon power."

The slip is one of no great importance in the article; but it involves a point on which many of your readers may be a little hazy.

If the earth rotated in a longer time than it takes the moon to revolve around it, the friction of the water on itself and the interference of land masses would retard the tides behind the moon. Then the pull of the tides on the moon would retard the moon and accelerate the rotation of the earth. As the earth rotates more rapidly than the moon revolves around it, the tides are carried ahead of the moon and their pull on the moon tends to accelerate its motion at the same time it retards the rotation of the earth. A development of power from the incoming tide might lessen these effects by lessening the height to which the tide would otherwise rise; but any development of energy from the outflowing tide would decrease its reaction upon the earth by which it returns some of the energy of the rotation of the earth it had absorbed during flood tide and it would prolong and increase the effect of the forward pull of the tides on the moon. Stated mathematically the attraction of the tides on the moon may be divided into two components, one toward the center of the earth and the other tangential to the moon's orbit. The tangential component carries the moon even a little farther from the earth and increases its potential energy at the expense of the energy of rotation of the earth.

Ceres, California. M. E. TAYLOR.



The operation of lopping the branches from the felled tree and cutting the bole into logs. Sweden

Packing the twigs and needles into bags in the forest, ready to haul to the distillery. Sweden

The Pine Needle Oil Industry

How the Thrifty Europeans Utilize a Waste Product of the Lumbering Industries

By Samuel J. Record

The distillation of the needles, cones and twigs of pines, spruces, cedars, firs, and other conifers, is an old-established industry in Europe. In America, however, the industry has been of a sporadic and uncertain character and it is doubtful if a single commercial plant is now in operation.

The amount of pine needle oil used annually in this country is not known. The importation of the principal firm handling this product is about 12,000 *pounds a year. The selling price last November,* 1915, *was* 85 *cents per pound.*—EDITOR.

IN Sweden the manufacture of pine needle oil, extract, and other products from *Pinus sylvestris* L. is an industry of considerable importance. The largest plant which is located at Jönköping is the outgrowth of a very small beginning made by an apothecary 30 years ago. Since 1907 it has been operated by a limited liability company under the style of "Antiebolaget Apotekare Alfr. Carlssons Enkas Tallbarrsoljefabrik." The accompanying illustrations of the industry in Sweden were furnished by this company.

The raw material is a by-product of the lumbering industry and gives employment to farmers, peasants and poor people in the district where the factory is located. After the trees are felled and trimmed, women and children collect the branches; with a long curved knife they cut off the twigs with their leaf clusters and small cones and pack them into large burlap bags. These are then loaded on wagons and hauled to the factory.

In the plant is a large chopping machine which cuts the leaves and twigs into very fine pieces to make distillation rapid. The stills are large wooden retorts with a capacity of several thousand kilograms of the raw material. Steam is passed through the mass and with the liberated volatile oil is condensed and later refined. This product, known as Swedish Pine Oil or officially as Aetheroleum Pini sylcestris, is a thin, clear fluid, colorless or with a slight greenish tinge, giving off the peculiar aroma of Scotch pine needles. It is bottled and sold for use in baths, as a deodorant in hospitals and sickrooms, and for various medicinal purposes.

The non-volatile extract that remains in the still is drawn off and refined into pine needle extract (*Extractum Pini sylvestris*). This extract is used solely for baths. The spent needles are dumped out in the open and after air-drying are used for fuel in the plant.

The Thuringen Mountains of southern Germany have long been an important source of pine-needle oil (Fichteunadelöl or Kiefernadelöl), extract, and similar products. The needles and twigs of the various kinds of pine trees, especially the mountain pine (*Pinus pumilio* Haenke) are used for this purpose. They are collected the latter part of May or early in June, cut into small pieces and distilled.

For small operations an ordinary pharmaceutical still is sufficient, but for larger plants, special apparatus is employed. The latter consists of a cylinder, with a false bottom, which allows the steam to pass upward through the mass of needles and out into the condenser. The false bottom is usually made of zinc and is perforated, the central part rising in the form of a cone or funnel to facilitate the steaming of the mass. The distillate flows into a jar and most of the oil rises to the surface and is skimmed off from time to time. Some of it, however, remains in the water which is usually subjected to a rectifying process or to an application of salts to prevent waste.

During the process of distillation some of the steam condenses in the cylinder and flows down through the perforated bottom carrying with it various resinous, albuminous, and tannated substances. This liquid is drawn off and evaporated in a vacuum apparatus until the desired consistency is reached. This product is known as pine-needle extract, but it is necessary to mix pine-needle oil with it to give it the proper perfume.

The mass left in the cylinder is taken out, dried, and shredded, and then perfumed with pine-needle oil and used for pillow and mattress stuffing. It is reputed to be healthful and vermin-proof.

The needles and branches of the mountain pine are also distilled on a large scale in the Austrian Alps and the oil obtained from them is extensively used in soap making and other purposes of perfumery.

In Switzerland and Tyrol the oil of the silver spruce (*Abies pectinata* D. C.) is extracted. In a pure state it has a very agreeable odor and is, therefore, largely used as a perfume. The young cones of the same tree are distilled in Switzerland and Thuringia and the oil appears on the market as pine needle oil. It has a milder odor and lower specific gravity than the oil prepared from the needles. The oil of the common spruce (*Picea excelsa* Lk.) is produced in various places in Europe. Spruce oil is extensively used for perfuming various compounds, especially shoe polishes.

The use of so many different kinds of conifers to produce leaf oils, and the tendency to group them under common names have lead to considerable confusion in nomenclature so that in many cases the botanical origin cannot be traced with certainty even from the latin labels.

A more serious matter, however, and one which has done much to retard the development of the industry is the debasing of pine needle products with oil of turpentine. Regarding this point, Prof. Carl Th. Mörner, a Swedish authority on the subject, says (Svensk Farmaceutisk Tidskrift, 1913): "The conditions prevailing can be denoted as far from satisfactory. Laying aside the question according to which technique the large quantity of oil of turpentine has been added (direct admixture or the use of oil of turpentine as 'menstruum'; the use of improper crude material, *i. e.*, large branches, etc.), one finds that in too many cases the circumstances point towards a too large quantity of turpentine and in connection herewith a too small quantity of the respective oils specific, more valuable constituent parts, in other words, towards inferior products. In many cases the abnormal quantity of oil of turpentine, or other foreign oil or both, is at the same time so dominating that the products can not justly claim the name given the same but must be designated as adulterated. (This is true in spite of the fact that the trade marks include such epithets as 'bestes,' 'extrafein,' 'echtes,' and others.) Of 28 products analyzed here only 15 can be characterized as perfectly good.

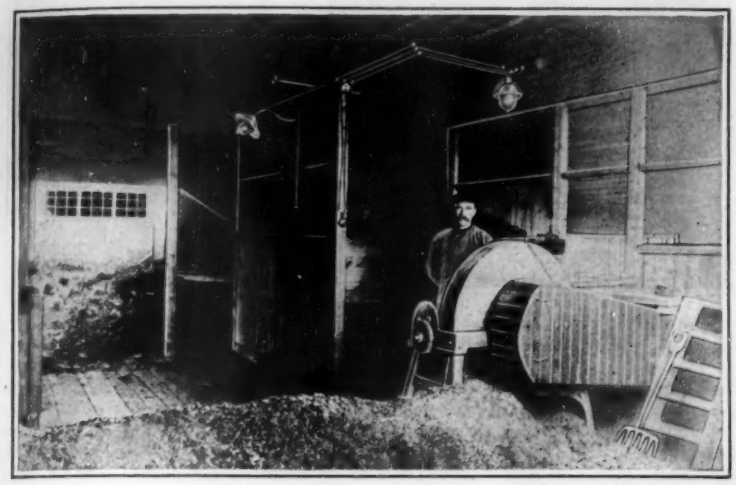
"The manufacture and sale of pine-needle oil seem to

Loading the bags of pine twigs and needles on wagons, before hauling them to the factory. Sweden

Unloading still for use in the distillation of pine needles. United States Forest Service Experimental Plant

be subject to unsound speculation of a similar nature to a very high degree."

Although, as previously stated, the industry has met with indifferent success in America, it is possible that it may be revived on a more substantial basis. The U. S. Forest Service has been conducting a series of investigations to determine the yield and composition of the leaf oils of the more important conifers with a view to utilizing what is not only a waste product of logging operations, but a fire menace as well. In order to prevent forest fires it is usually necessary to dispose of the slash in some way, either by burning or by "lopping" and scattering the limbs so that they will lie close to the ground and rot quickly. This work is at present a dead expense which in some instances at least might be turned to profit by distillation of the twigs and needles.



Cutting machine for chopping pine needles and twigs into pieces for the retorts Carlssons Enka, Jönköping, Sweden

To obtain specimens of the oils a small distilling apparatus was constructed that had a capacity of from 350 to 400 pounds of chopped needles. The device consisted of a copper heating vessel surmounted by a detachable copper container in which the chopped needles were packed. The bottom of the container was fitted with a brass wire screen through which the steam from the boiling water below made its way into the charge. A removable cover was connected with the condenser—a copper coil in a galvanized tank through which cold water was flowing. The distillate was collected in a large bottle from which the water was drawn off from time to time and returned to the heater.

The twigs and needles were run through a feed cutter and chopped into lengths of from one half to one inch. No twigs more than one half inch in diameter were included. In some instances the needles alone were used, but this selection of material was not considered justified by the small difference in results. Although the oil from the leaves consists of aromatic compounds, while the oil from the twigs is of aliphatic derivatives, the composition of the product obtained from distilling needles and twigs together is not seriously affected if only small twigs are included.

The time elapsing from the time the fire was lighted under the heater until the distillate appeared was between two and three hours. Seven or eight hours were required to complete the distillation process. The spent needles were dumped from the container by means of a swinging pole which lifted the cylinder from the heater.

The oil from the receiver was dried, filtered, and weighed, and the percentage yield based upon the original weight of material in the charge.

The yield from different species of conifers was found to vary greatly, as follows:

	Yield per cent.
Longleaf pine (*Pinus palustris* Mill.)	0.381-0.429; ave. 0.401
Cuban pine (*P. heterophylla* Sudw.)	0.268-0.278; " 0.271
Western yellow pine (*P. ponderosa* Laws.)	0.040-0.126; " 0.112
Sugar pine (*P. Lambertiana* Dougl.)	0.045-0.120; " 0.084
Digger pine (*P. sabiniana* Dougl.)	0.078-0.102; " 0.088
Lodgepole pine (*P. contorta* Lond.)	0.234
Douglas fir (*Pseudotsuga taxifolia* Britt.)	0.11 -0.20; " 0.163
White fir (*Abies concolor* Parry.)	0.029-0.272; " 0.128
Red fir (*A. magnifica* Murr.)	0.154

In addition to the oil it is possible to obtain from the needles a fibrous product known as pine wool. Pine needles consist of thread-like bundles of tough fibrous material which provide the strength and pliability of the green leaves. If distilled without preliminary chopping the spent leaves can be freed of the non-fibrous material by boiling in a soda solution, followed by a series of washing, drying and heating operations. The resulting fiber representing some 13 per cent of the fresh needles is fine, strong, and elastic, resembling hemp and can be curved, felted or woven. Though darkened by the soda treatment it can be bleached and afterward dyed if desired. The long needles of some of the southern and western pines are particularly suited to the manufacture of this fiber. Since the leaves cannot be chopped it is necessary to crush them in order to free the oils.

At the World's industrial and Cotton Exposition at New Orleans 30 years ago, one of the exhibits was samples of pine needle products from North Carolina. In this collection was pine hair for upholstering purposes, being "so prepared as to preserve the balsamic odor;" another grade for use as a substitute for hair in plastering; some pine wool which was claimed to be the nearest approach to natural wool ever made from vegetable fiber and intended for spinning and weaving into mattings and carpets, and represented to take and retain dyes without a mordant.

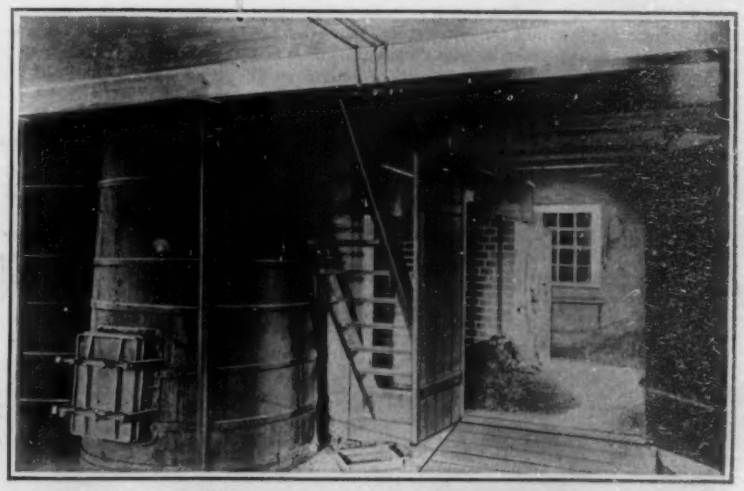
Cutting pine needles and twigs in a feed chopper, for use in United States Forest Service experimental still

In Bulletin No. 18 of the U. S. Division of Forestry published in 1896, Dr. Charles Mohr makes the following statement regarding the utilization of the needles of longleaf pine: "The green leaves of the tree furnish by distillation an essential oil of balsamic odor closely resembling spirits of turpentine. The so-called pine wool is made from their cellular tissue, being heated with a strong alkaline solution at boiling heat, the remaining fiber being cleaned and carded. This pine wool is used in upholstery, and is said to be of value as an antiseptic dressing for wounds. Of late years it is manufactured into various kinds of textile fabrics. One fabric is a carpet which resembles cocoa matting somewhat, but is closely woven and is naturally of a rich brown color and very durable. This industry, only recently established, has already met such success that the manufacturers have added twenty-nine looms to their work."

In 1904 U. S. Patent No. 758,874 was granted to two residents of Grants Pass, Oregon, covering a method of treating pine needles. One of the claims reads: "Subjecting pine needles to the action of steam to liberate the oil and obtain the extract, crushing the needles to remove the wood from the points thereof, converting the crushed needles into fiber, shaking the fiber and sifting the same to remove dust and waste, and washing, wringing and drying the fiber." A company was incorporated and a plant said to have cost $50,000 was erected at Grants Pass. After a few years the undertaking was abandoned and has not been resumed.

It is interesting to note that, coincident with the investigations of the U. S. Forest Service, the Forest Research Institute at Dehra Dun, India, is urging the utilization of chir pine (*Pinus longifolia* Roxb.) for the production of pine needle oil and other products.

It was found that chir-needle oil is of standard composition, and the content is 0.57 per cent based on green weight or 1.4 per cent calculated on dry material. On the basis that a tree produces 400 pounds of needles yielding 0.57 per cent of oil, it is estimated that the Kumaun Circle alone could produce 45,600 pounds of oil, or about 5,000 gallons. It is proposed to divide the work between a number of small portable distilleries located near felling areas. A typical distillery would consist of one portable boiler of 5 N. H. P., a battery of two stills worked by it, with a capacity of 400 pounds each. With two charges a day the yield would be 9.12 pounds of oil per day or about 25 gallons of oil per month of 25 days. The coöperation of the medical and sanitation departments is urged with a view of creating a good demand for the oil and by-products.



Wooden retorts for distilling pine needles at Carlssons Enka Plant, Jönköping, Sweden. Boiler-room shown at right

Deriving Fat from Yeast

By Our Berlin Correspondent

AT the recent meeting of the Experimental and Academical Brewery, Berlin, Prof. Delbrück made a startling announcement. It had been, he said, the constant endeavor of those attached to that establishment, from the outbreak of hostilities, to utilize yeast not only as a producer of albumen, but for yielding fat. Now, a pupil of the Institute of Fermentation Industries, Herr Schrettkenaager, had sent a package from the trenches, the contents of which turned out to be a dried fungus mass. On examining this under the microscope, Prof. Lindner found each individual cell of it to be filled with a drop of gelatine. The fatty yeast so long sought had at length been discovered.

On further examination the yeast proved to contain 18 per cent fat and 30 per cent albumen. Expert advice goes to show that already a product containing 10 per cent fat could be worked on a commercial scale with good results. Attempts were at first made to cultivate the new yeast according to the same process as albuminous yeast, but, in accordance with its special character, it was found to require much rest, and, therefore, it was reared in thick layers on iron plates.

The Fats and Oils War Committee, which was immediately informed of the discovery, showed its great interest in the matter by awarding a considerable sum. It is thought that the discovery will even during the period of the present war reach a stage of practical utilization.

The large-scale production of fodder yeast is likewise proceeding most satisfactorily.

One of the establishments where Italian boys and girls prepare compressed newspaper fuel for their soldiers in the mountains

Method of cutting a rod of compressed newspapers into small pieces. The pieces are afterwards placed in individual bags for distribution

Waste Newspapers as a Fuel for Military Camps

ITALY has aptly and inexpensively solved the problem of supplying her soldiers, who are campaigning in the mountains where dry wood is scarce, with suitable fuel for their camp fires.

In all the leading cities of Italy there have been organized bands of boys and girls who go about collecting all the discarded newspapers they can find. These are brought to establishments where other boys and girls convert the sheets of paper into solid rods of fuel, under the direction of women teachers. These are then cut into short lengths and packed in individual bags for distribution among the soldiers in the mountains.

It is said that the compressed paper fuel is not only entirely satisfactory for the purpose intended, but also most convenient. Should a soldier desire a little hot soup or coffee he only requires three or four pieces of this unique fuel to heat the food. Lightness is another consideration in favor of the improvised fuel, especially in the mountains where weight is a paramount factor.

Transportable Bungalow Drawn by Runabout

TO provide himself with a comfortable shelter at all times while on his journeys about the countryside engaged in distributing religious literature, S. W. Beasley, of Pomona, Calif., has had built for his use a transportable bungalow that is drawn by a light runabout. The method employed in distributing the weight of the transportable shelter as well as in the application of driving power to the wheels makes this odd road train of more than passing interest.

A careful examination of the two accompanying illustrations reveals the fact that the rear wheels have been removed from the runabout. In their place is a jack shaft provided with a differential. The runabout frame is extended back to make the front wheels of the house serve as the middle set of wheels for the train. Strange as it may seem, the automobile is not marred in the least and it can be changed back into its original form within 20 minutes by removing the sprocket wheels and disconnecting the extension. When the owner arrives at a community where he desires to carry on his extension work, he can disconnect the bungalow member of the equipment and ride about the locality in the runabout.

The shelter, which the owner calls an "automobungalow," is most complete and comfortable. Its sleeping accommodations comprise one full sized and three three quarter sized beds. When these are folded up there is a curtain on the inside which serves to shut them off from the living room. On the other hand, when they are folded down the same curtain forms a roof and separate side curtains can be buttoned on to completely enclose the bed with canvas. At one end of the bungalow is a gasoline range, with a sink beside it. Hot and cold water is forced up from a tank under the house by means of an air pipe fed by a bicycle pump. Above the sink is a china closet, while to one side is a linen closet and a cooling closet. In the middle of the room is a collapsible dining room and library table. A dressing room of about the same size as a telephone booth is placed at the opposite end of the house, and in one side of it is installed a clothes press. Just outside the dressing room is a built-in writing desk, with a mirror over it. Beneath the desk is a built-in book case. The accommodations, it is believed, will comfortably house five people.

"Day and Night" Danger Signal

NOTWITHSTANDING the fact that the red lamp or flag is being supplanted as a danger signal to a great extent, it will be several generations before red has ceased to be popularly regarded as an indication of the presence of peril. The red light has been made use of in the design of an entirely new type of railroad warning recently built by the Southern Pacific Company. The feature of the signal is the fact that the red lamp is utilized as a daylight signal as well as for night use. Ordinarily a red light which shines out at night, cannot be seen when the sun is in the firmament above, but this red lamp is placed to the rear part of a 3-foot tube which is suspended in a horizontal position on a post at a point about on the level with the eye. This device constitutes a distant signal principally for warning automobilists of the presence of the crossing which is 100 feet beyond. The open end of the tube is pointed away from the crossing so that the point of red light is seen clearly in the center of an inky circle by the chauffeur when he is several hundred feet away from the tracks, where he has ample warning to look out for trains. As a further means of attracting attention, there is a large disk surrounding the tube which is painted red with white stripes. The first of these signals were erected at the crossing in Tropico, Cal., and the device has been regarded with so much favor that its use will be extended to other points along the line.

An Easy Way to Waterproof Clothes

HUNTERS, fishermen, and other lovers of out-door life, may find it to their advantage to take a leaf from the advice of the French Academy of Science to soldiers on the subject of waterproofing their garments. The process recommended is simple and easy, durable, inexpensive, and does not injure the appearance of the clothes. It consists, according to *La Nature*, of a very slight impregnation of the fiber of the cloth with wool-fat. This is dissolved and diluted in a neutral, anhydrous, and volatile liquid. One takes 5 to 10 parts of *Adeps lanae*, procurable at almost any drug store, liquefies it in a little chloroform and dilutes with 90 to 95 parts of gasoline (*essence of petrol*). The entire uniform, braid, buttons, and all is immersed in it, squeezed or stirred in it for a few minutes, then wrung out and dried in the air.

The woodsman may complete his preparations to defy wet weather by giving his heavier equipment, bags, leggings, etc., another treatment recommended in the same journal to render articles of coarse cloth or canvas impermeable. Such articles are smeared thoroughly with a mixture of talc with 50 per cent vaseline. Red vaseline is best, since it costs less and gives an attractive khaki color. The paste is applied much like shoe blacking, and is then rubbed in vigorously with a brush to make sure of an intimate contact.

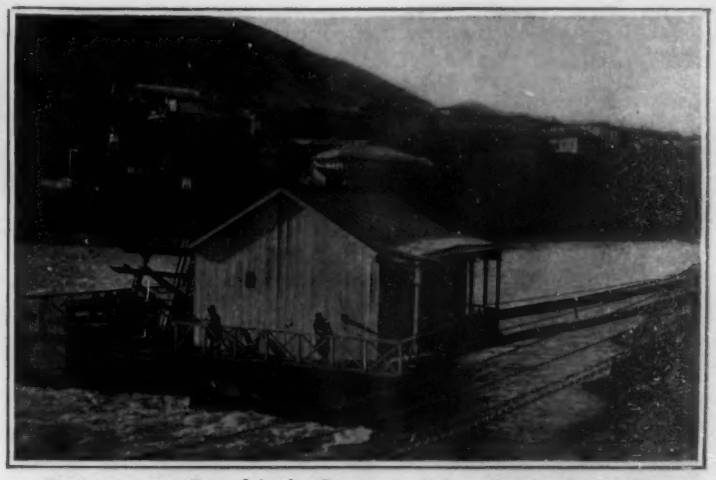
Mortar from Carbide-Mud

IN the production of acetylene gas from the union of calcium carbide and water, the residue consists of a considerable amount of "carbide-mud." Hitherto this has been considered useless, but the increased use of acetylene during the war has resulted in such large quantities of this by-product that German chemists have been trying to find a use for it. It is now announced in the *Chemiker Zeitung* (Berlin) that when mixed with 40 per cent of building sand it provides a very usable mortar, which hardens well and binds the stones firmly together.

The "automobungalow" at rest, showing how the beds are arranged when in use

The "automobungalow" or motor-hauled house in transit from one community to another

View in the mountain districts of the Philippines, showing the man-made terraces for the cultivation of rice



Floating water mill used in the Caucasus, which continually changes its location in accordance with its trade requirements

Rice Terraces of the Philippines

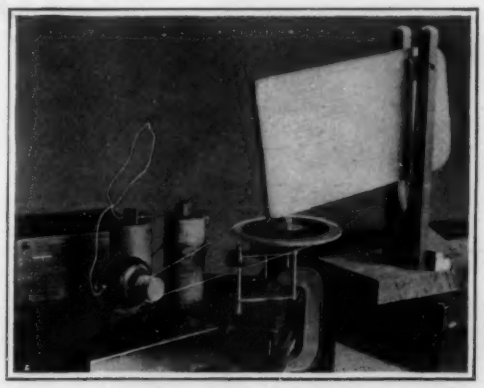
RESEMBLING the great works of Nature such as the Grand Cañon of the Colorado and Yellowstone Park, the rice terraces in the mountain provinces of the Philippines appear to be the result of erosion or glacial action rather than the work of humanity. Yet they are absolutely artificial; the mountain sides being terraced by the patient labor of the islanders so that rice can be grown on the slopes of the precipitous ranges. The rice terraces extend for almost countless miles and are by no means haphazard in their arrangement. In fact, an officer returning from the Philippines described them as marvelous engineering feats, since the water from the upper terraces is carried from level to level on easy grades, breaking the force of the current and irrigating mile after mile of rice fields.

Home-Made Phonograph Possessing Good Tonal Qualities

THAT a phonograph of good tonal qualities can be made from an ordinary pin and a shingle was demonstrated recently by the engineers of the State University of Iowa in their annual exhibition, when such a machine delighted hundreds of visitors with its rendition of popular airs. Strange as it may seem, a phonograph made after the pattern of that shown in the accompanying illustration will compare favorably with many of the machines on the market and is far better than the early attempts of the talking machine inventors.

Since the illustration clearly shows the construction of a shingle phonograph, but little explanation is necessary. Perhaps the most difficult step in the work is the mounting of the record so that it will run smoothly and at the right speed. In this instance an electric battery motor is used as the driving power; the speed being controlled by the number and strength of the cells used. If the builder of the phonograph is sufficiently ingenious, he can make a rheostat or wire resistance which is inserted in the battery circuit; or, failing in this, a rheostat can be purchased at a moderate cost. Careful attention must also be given the belting connecting the motor pulley to the revolving table. If the motor is of unusually high speed, it will be necessary to reduce the speed in two steps which can readily be done by the use of large and small wooden pulleys. It will be noted in the machine illustrated that the reduction in speed is effected by the difference in ratio between the motor pulley and the grooved wooden disk serving as the revolving table for the records. The materials needed in making the phonograph are knitting needles, quarter inch hard wood boards, small nails, battery motor, battery, string for belting, and a washer, nut and screw to clamp down the records on the turntable. Instead of using ordinary pins as the reproducing styluses it is advisable to employ the conventional forms of phonograph needles; but as to the particular variety of needle best suited it is impossible to state, since it depends largely on the weight placed on the stylus by the shingle used.

From the standpoint of the experimenter, the simple homemade phonograph possesses advantages in that its speed can be varied over a wide range and it can be operated with equal ease in either direction. Thus a record can be rendered in the manner intended and then in the opposite direction. The novelty of hearing the records in the contrary direction affords almost endless amusement and doubles the entertainment value of each one.



Experimental phonograph using a shingle to impart the sound waves to the air

Water Mill Built on a Boat

THERE is in actual use on the Kura stream in the Caucasus a water mill which does not follow conventional practice in that it is continually changing its location. To render its transportation a simple matter, this mill is mounted on a boat-like body, as may be seen in the accompanying illustration. Heavy booms and chains are used to anchor the floating mill at any desired point.

Although the traveling water mill would appear to be more of a curiosity than a practical plant, still, it possesses the one striking advantage that it does not have to wait for work to be brought to it, but instead goes forth and seeks its work. It remains at one point until the available amount of work is exhausted, whereupon it moves up or down the stream in search of new trade fields.

Collapse of a Municipal Lighting Tower

FIFTEEN tons of structural steel fell from a height of 200 feet at the intersection of the two principal streets of San Jose, California, at noon, December 3rd, 1915, without injury to anyone or the crushing of adjacent buildings. The steel was in an immense electrical tower, which had long been a feature of the city. For nearly a year the tower had been in disuse by reason of damage by storm. Repair work had been in progress for several weeks; the structure had been wired, the illumination tested, and it was soon to be turned over to the municipality by the contractors when it collapsed under the stress of a 60-mile gale, which exerted a pressure of 23 tons against the corner posts.

Fortunately, the snapping of brace-rods and an ominous swaying of the tower gave warning to pedestrians to get out of the way. Two automobiles, however, drove beneath the tower at the moment of its collapse; the drivers saving themselves by quick bursts of speed. A broken trolley wire writhed in the street for several minutes, sending up a sheet of blue flame. The crash was heard for many blocks.

The tower was an historic structure, having been built in 1881, when the city was first lighted by electricity. After it had been demonstrated that such method of lighting was less desirable than street lights, it was retained because of its unique character and the distinction which it gave the city. One leg of the immense structure stood at each corner of the square, all traffic passing beneath the skeleton, which tapered to a point 200 feet in the air. For 33 years the tower withstood the heavy gales of that region, but in February, 1915, was so badly damaged that it had to be taken down about half way.

During the subsequent months the tower was rebuilt at a cost of $6,100, the fund being raised by subscription. A public dedication ceremony had been planned and was scheduled to take place within a few days. It has now been decided not to rebuild.

Investigations following the collapse disclosed that the main beams had lost much of their original strength and resiliency and that they were unable to withstand the weight of the new work above. This condition was ascribed to natural disintegration and to the constant vibration caused by traffic. In falling, the tower seemed to twist and crumple; the bulk of the debris crashing upon a staging which had been built to a height of 40 feet.

Illuminated municipal tower of San Jose, Cal.

Ruins of the tower following its collapse in a 60-mile gale, on December 3rd, 1915

American Seismographic Observations.

IN gratifying contrast to the neglected and uncoordinated state of seismological work in North America a few years ago, it is noted in the current annual report of the Chief of the Weather Bureau that the bureau is now collecting and publishing instrumental records of earthquakes from the following places: Sitka, Tucson, Honolulu, Cheltenham (Md.), Porto Rico, Point Lomo (Cal.), Denver, Georgetown (D. C.), Lawrence (Kans.), Cambridge (Mass.), St. Louis, Buffalo, Fordham (N. Y.), Balboa Heights (C. Z.), Ottawa, Toronto and Victoria. The institutions furnishing these reports include stations of the Coast and Geodetic Survey, various universities and colleges, and the Canadian meteorological service. The Weather Bureau maintains seismographs of its own at Washington and at Northfield, Vt. Besides these instrumental records, the bureau collects non-instrumental reports of earthquakes from all its 200 regular stations and from most of its 4,500 co-operative observers, and these are published regularly in the *Monthly Weather Review*.

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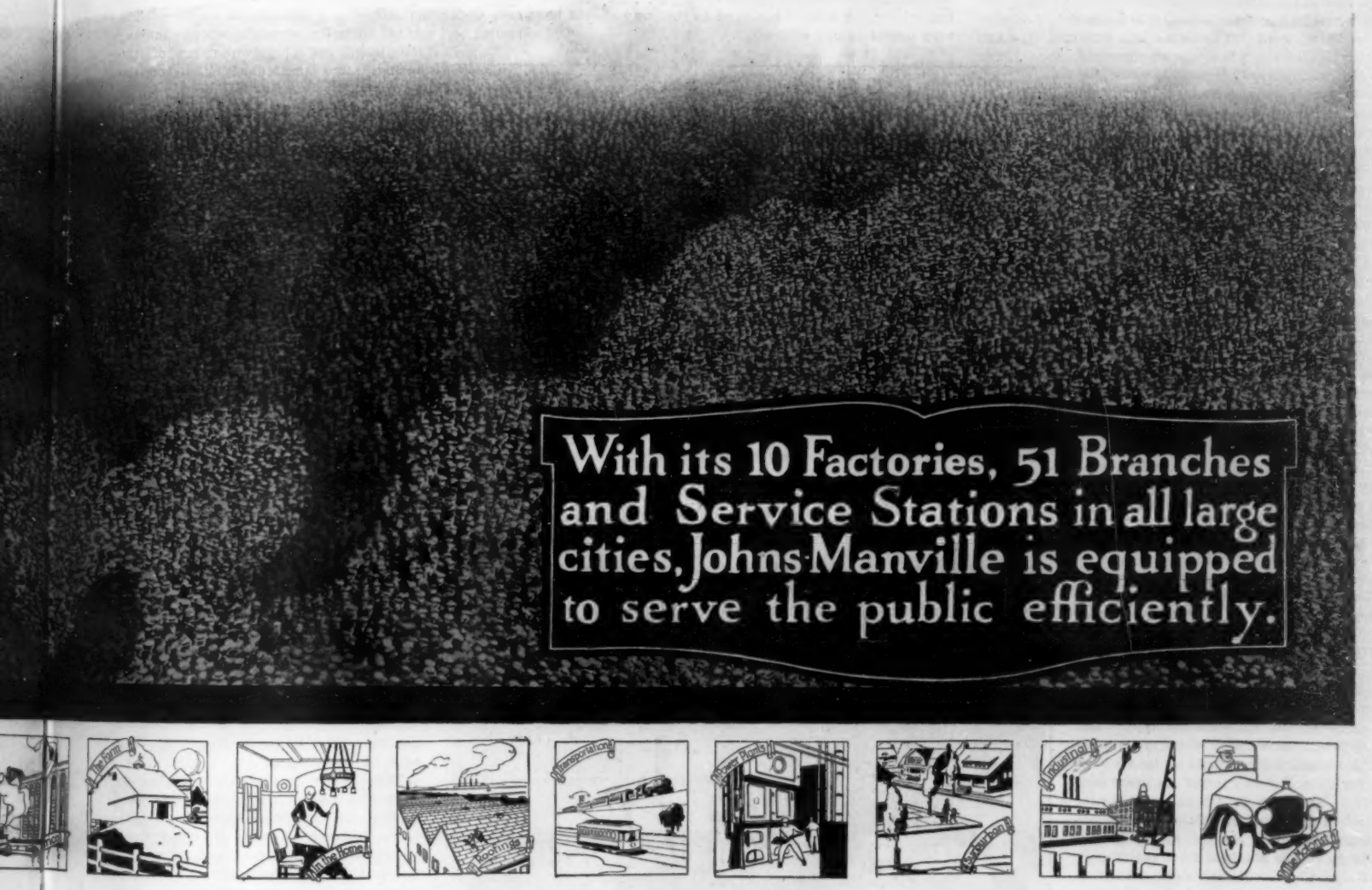

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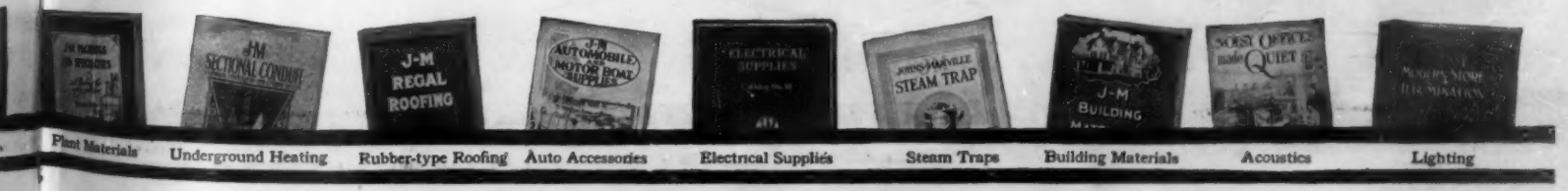

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The Motor-driven Commercial Vehicle

Conducted by VICTOR W. PAGE, M. S. A. E.

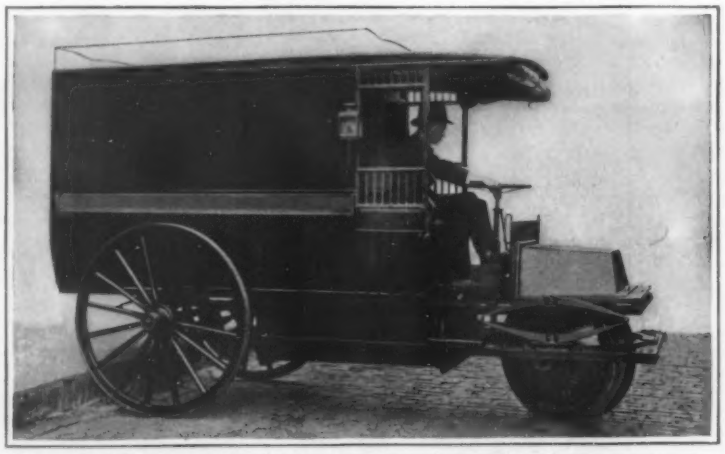
This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles

One-Wheel Electric Tractor

A CHICAGO manufacturer has just perfected a one-wheel tractor arrangement intended to convert horse-drawn wagons into electrically propelled trucks. The attachment consists of a single wheel constructed of cast steel and equipped with a 3½-inch dual solid rubber tire of the usual pattern used on trucks. The electric driving motor is located in the interior of the wheel and delivers its power through a pinion at the end of the armature shaft which engages a large gear attached to the interior rim of the wheel. As the motor is carried inside of the wheel, it is completely protected from the elements. The motor is a standard type and both sides of the wheel are so arranged as to permit ready removal when the motor requires inspection or lubrication or when repairs are necessary. It is not necessary to remove the side plates to inspect the mechanism in the wheel interior as an accessible door in one of the wheel sides provides every opportunity for inspection.

The vehicle is steered by the usual form of handwheel which operates a pinion engaging in a gear arranged on the circular frame which carries the traction member. When the frame is turned the proper degree of wheel angularity is secured to obtain the desired direction of movement. A foot-actuated lever operates the brake, the retarding force acting on a brake drum on the end of the front axle. The entire apparatus is securely attached to the body of the vehicle by means of steel frame bars or perch rods extending from the front to the rear, which also act as supports for the storage battery container which is carried under the vehicle body.

When the tractor assembly is in place a substantial front drive electric vehicle having as much power as the average electric truck is obtained. The attachment can be applied to any vehicle at a low cost and should make possible motorizing fleets of horse-drawn delivery wagons by those firms who would otherwise be disinclined to sacrifice a good horse-drawn equipment to purchase complete electric vehicles of the conventional type. The attachment offers many of the advantages of the usual motor truck, as its tractive power is sufficiently great to draw any vehicle to which it can be conveniently attached and, because of the efficiency in transmission, it is claimed that a greater mileage can be obtained from the storage battery. The use of one combined traction and directive wheel eliminates a differential, universal joints, some power transmission and speed-reduction gears and steering knuckles. This construction makes possible the use of standard vehicle springs, the regular wheels and rear axle, and small rubber tires on the rear wheels, which amounts to considerable saving. For slow speed vehicles such as used in municipal service for street cleaning, garbage disposal, etc., steel tires can be used on the rear wheels.



One-wheeled-tractor designed to convert a horse-drawn vehicle into a motor truck

Useful Winch Attachment

TRUCKS that are used in handling heavy materials that are difficult to load or unload by man power are sometimes provided with a hoisting winch and boom. The truck illustrated herewith is used by the city of Detroit in the street lighting department and is employed for conveying materials of construction. The utility of the winch and boom is apparent as it is shown hoisting a heavy cast iron lamp post and assisting the workmen in placing it. The hoisting drum is driven by the truck power plant through the medium of a manually controlled clutch. The winding drum movement is retarded when desired by a hand-actuated brake. The winch arrangement is placed immediately back of the driver's cab in the space just ahead of the truck body. A vehicle equipped in this way should be very useful to any contractor.

A power-driven winch mounted as part of the motor truck

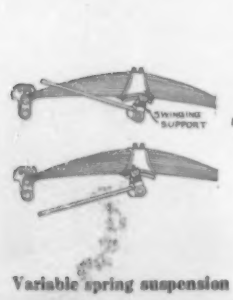
Variable Springing

AN English engineer has recently devised a scheme for varying the strength of the load-carrying springs to suit the different running conditions and, while initially contrived for and used on the lighter private cars and confined to a cantilever spring, it seems to be a development in the right direction. As shown in the accompanying sketch the action depends upon the principle that a shorter spring is stiffer than a long one and that the period of spring movement depends upon its length. A short spring will have a quick period, while a long one will be slower in action. The usual cantilever spring is shackled at its front end and is secured to a rocker joint about midway of its length. This type of spring has its action checked by the shackle at the front end. The working of the cantilever spring depends to some extent upon the length ahead of the oscillating fulcrum being less than that of the spring from the fulcrum point to the rear axle. The rear part of the spring is actuated by the lighter and less rapid road shocks, while the front part acts under the stiffer and more rapid stresses. The system of spring variation depends upon changing the length of the two parts of the spring, more particularly that of the back end, by a swinging support which changes the fulcrum point and consequently the characteristics of the spring.

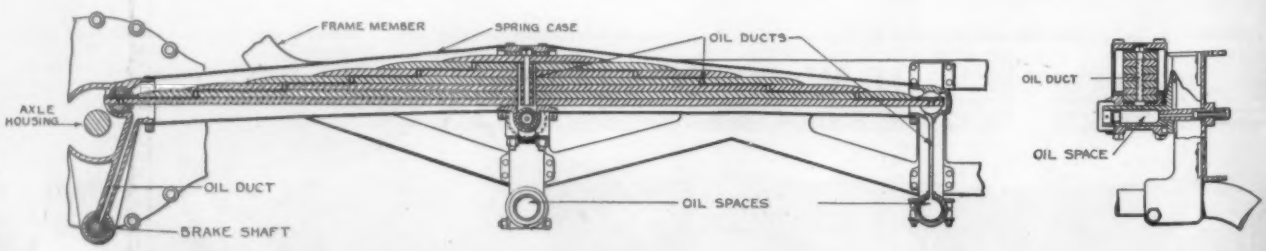
An Automatically Lubricated Chassis

IT is a matter of common knowledge to those familiar with the repair of motor trucks that a large part of the mechanical depreciation and many of the break-downs which occur are brought about by failure to properly lubricate the parts. On the average commercial car chassis there are a large number of minor though important working points that should be oiled daily. These are either provided with small oil cups to be filled with a hand oil can or syringe or screw down grease cups. Many of these are located in relatively inaccessible places and it is certain that they will be neglected. A new pleasure car chassis has recently been developed in England in which the matter of lubrication has been carefully worked out by the designer so that practically all of the moving parts are lubricated automatically by the engine. A comparison made between a chassis of conventional design and that of the new car shows that there are but eleven points requiring attention as against the fifty or more parts on a chassis of the usual construction. The only daily attention required of the driver of this distinctive car is to keep the oil level in the engine sump up to the required height. The lubrication of the other points need not be performed more frequently than once in six months.

This factor of automatic lubrication, while first applied to a pleasure car should receive the careful consideration of the truck designer as well, especially when one considers that many truck drivers are mechanically inexperienced. Automatic lubrication is not only preferable because it saves time, but also because it insures lubricating parts that would not otherwise receive attention. A car in which the engine is made to feed filtered oil to the center of practically every moving part is desirable, because with such a design mechanical depreciation and consequent repair bills will be reduced to a very low point. The lubrication of the entire interior of the engine by circulating the lubricant from a sump or oil container integral with the engine has been common practice on both sides of the water for a number of years. To utilize this same oiling system for lubricating the change speed gearing, rear axle and such usually neglected parts as the springs, brake rods, etc., is certainly novel and distinctive.



Variable spring suspension



Sectional views showing how the springs are automatically lubricated in the new English chassis

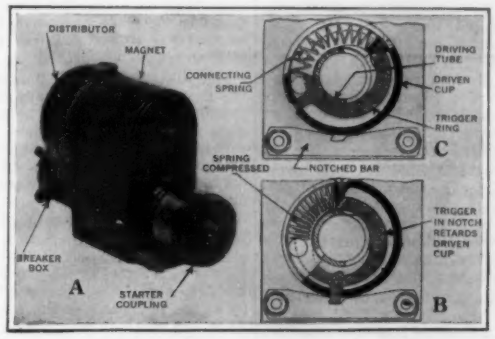
The oil sump incorporated at the base of the engine is of larger capacity than that ordinarily provided. The lubricant passes through a filter before it reaches the pump and is delivered from that member under a pressure of about 20 pounds to the square inch (when the oil is hot), to the center crankshaft main bearing, whence it passes through the hollow shaft in either direction and lubricates the entire interior of the power plant in the conventional way. The internal oil channel between the oil pump and the filter is tapped and an oil pipe is led from this to feed all of the small moving parts of the chassis other than the hand brake quadrant and the steering joints. This pipe runs completely around the car inside the channel of the frame and returns to the engine base.

At the points where the pipe passes the four brackets to which the centers of the cantilever springs are pivoted, small steel branch pipes are let off and enter the centers of the spring fulcrum pins. Each of these spring fulcrum pins is drilled throughout half its length and the oil feeds from the inner end of this channel through a small hole drilled downwards at right angles to the outer surface of the pins and its bearings. The hole is normally sealed by the pressure of the fulcrum pin on the lower half of the bearings, but when the springs are working, some of the oil seeps out through the hole around the pin and along an oil channel drilled through the centers of all the spring leaves, except the short top leaf. The leaf immediately below the top leaf has on its upper surface shallow grooves extending in each direction from the center to within a few inches of its rounded tips and the oil finds its way down these grooves from one spring leaf to the other as clearly shown in the accompanying illustration. Each spring is bound in a leather case to keep the oil in and the dirt out. These leather cases are held on by clips against properly formed flanges. The anchorages of the cantilever spring ends are of the sliding type, no swinging shackles being fitted.

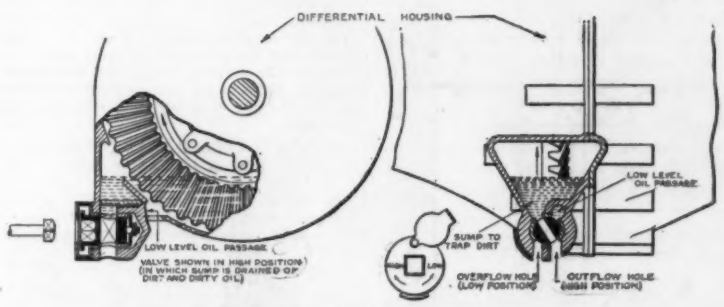
After passing along the spring leaves, the oil passes to the brake actuating shaft from the front end of the rear spring, while from the rear end of the front spring the oil goes to the clutch and brake pedal cross shaft. The rear ends of the back springs project into the back axle casings and oil leaking from the rear springs keeps up the level of lubricant in the rear axle. The steering joints for both the fore and aft and cross rods are lubricated from oil contained in the hollow rods themselves. A section of the tie rod showing the ball joint and the filler plug is shown at B in the accompanying illustration. The tie rod is filled every six months and no further attention is needed as the ball joint is not only copiously lubricated, but is well protected with dirt-excluding closures. The interior of the hollow front axle also communicates with the drilled pivot pin and any lubricant forced into the axle must not only lubricate the steering pivots, but the front wheel bearings as well.

As much of the oil from the chassis parts flows into the rear axle, it is apparent that some dirt must be carried into that member. This is very well taken care of by providing a sump on the rear of the differential housing which collects dirt splashed up against a deflector by the revolving gear, provision being made for draining this sump from time to time as desired. Considerable attention has been devoted to the designing of oil-tight joints. It would not be practical to devise a lubrication system of this nature if the oil could escape from the bearing points lubricated as quickly as it does with the ordinary type of car. A sealing cap is provided on the outer extremities of practically all of the lubricated joints which is very much the same as a standard road wheel hub cap, except that it is on a small scale. It should be realized that the care taken to retain the oil means that dirt will be excluded as well.

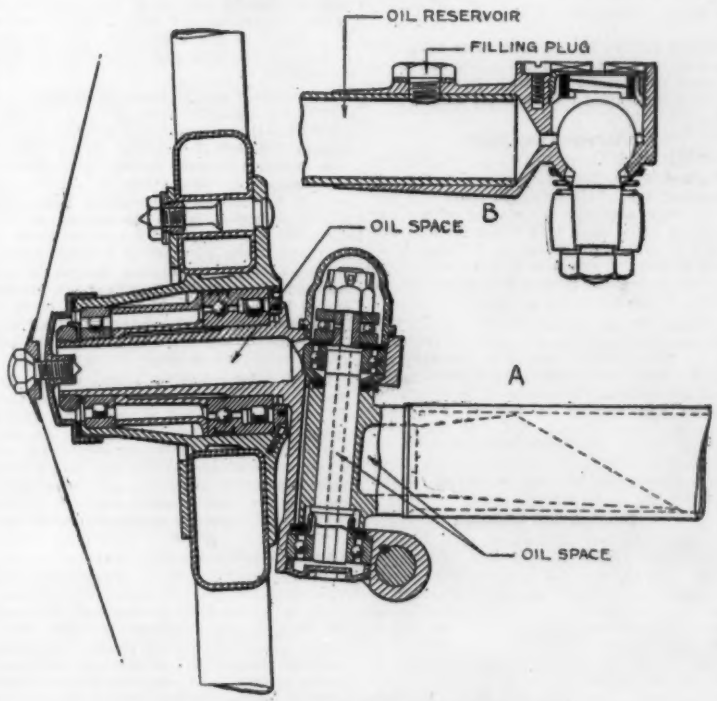
Space does not permit an extended description of this ingenious lubrication system, but the writer can see no reason why a refinement of detail, such as shown in the accompanying sketches, could not be worked out to advantage on a motor truck chassis. It would seem possible that many of the chasses as at present designed could be made self-lubricating without much trouble. Wherever tubes are used the interior of the tube can be used as an oil reservoir which need not be filled very often. This is especially true of the joints on the steering connections which are grossly neglected at the present time and which wear rapidly as a result of this neglect. It appears that the ball joint, such as shown at B is not only the best form for steering connections, but it could be used with equal advantage at the ends of the brake rods, radius or torque members or, in fact, for any joint where a free acting, long lived and easily adjusted connection is desired. It would be infinitely superior to the usual simple yoke and pin arrangement which is now standard practice. Even without going to the extreme refinement of detail as displayed in the new chassis, many of the joints could be enclosed in leather cases which could be filled with a semi-fluid lubricant. Automatic lubrication of all chassis parts is of paramount importance on vehicles intended for commercial work and should be carefully studied by all motor truck designers. Further truck development must be more in the line of refinement of details rather than in any startling innovations in power plant or chassis construction and nothing could be of more importance than insuring proper lubrication of the mechanism and reducing upkeep costs.



Impulse starter for magneto



Method of lubricating the differential



Automatic lubrication of the steering axles

Motor Truck Queries

W. P. V. writes: I have a large truck equipped with a 60-horse-power four-cylinder engine. The ignition is by high tension magneto, set spark. No batteries are provided. I find it difficult to start the engine on cold mornings because the cylinders are so large I cannot "spin" the engine, even with the decompressor open. Do you believe the fault is in the magneto? Do you think an auxiliary battery ignition system would help matters any? A. An auxiliary battery system would make the engine start easier providing the trouble is not due to the mixtures being too thin. First, try a little richer mixture than you have used during the summer. Try priming the cylinders with gasoline before trying to start the motor by cranking. Have the spark time advanced slightly. A battery system will be expensive as you will need a special form of magneto for either dual or duplex ignition, though a one-coil distributor system may be installed providing there is any place you can attach the distributor where it will be driven at the correct speed. The maker of your magneto may be able to change this over to a dual system which will be the easiest way to obtain the advantages of the battery system in securing an easy start. Special forms of couplings, as illustrated herewith, may be used to drive the magneto armature. This provides a hot spark even when cranking slowly as the armature speed is accelerated by a spring arrangement so the speed approximates that obtained when the engine is turning over under power. The device is said to have no effect upon the regular operation of the magneto except at slow speeds, when it causes the armature to rotate in a series of jumps instead of at a uniform speed. These jumps cause the armature to cut the lines of force of the magnets quickly, or at the same speed that it does when the motor is revolving swiftly, so that a hot spark is generated. This removes any necessity for auxiliary battery ignition for starting heavy-duty motors, for a hot, fat spark is generated at any speed, regardless of how slowly the crank is turned.

The coupling consists of a driving tube in the center and a driven cup, inclosing the device, the two being connected by a spring. Within the driven cup is a loose ring, known as the trigger, this ring having a lip which extends through a slot on the periphery of the cup. At the bottom of the coupling is a notched bar, so positioned that as the cup revolves the notch registers with the slot in the cup so that the trigger lip drops down by gravity and thus locks the cup against the rotation. This is the position shown in the lower view. On the inside of the trigger ring is a cam which engages a corresponding cam cut in the driving tube. When the lip has engaged the notched bar and the cup ceases to rotate, the driving tube continues to turn. This turning compresses the spring, which is seated against a driving pin on the tube and a block fixed to the cup. At a predetermined point the cam on the trigger ring engages that on the tube and lifts the trigger far enough so that the lip disengages the notched bar, and the compression of the spring spins the cup around in a clockwise direction. The magneto armature is connected with the cup, and so, as the cup spins around the armature is given a quick twist, producing a hot spark. At slow speed, as the cup revolves, it is caught again and again by the trigger, but when the motor fires, the speed is so increased that the trigger ring, by its own weight becomes a ring governor, and centrifugal force keeps it from dropping down into the slot. In this state, the coupling acts as a dead connection between the drive and the armature, a small lug on the inside of the trigger ring, at the point where the lip juts out, engaging a notch in the driving tube and thus providing a positive drive as long as the speed is maintained. The device includes a standard coupling for connection with the shaft.

G. P. writes: Will you inform me if the caterpillar tread type of tractor would be suitable on newly cut roads through a timbered country. I live in northeastern Oklahoma in the foot hills of the Ozarks and expect to buy a tractor for next summer delivery. I expect the machine to pull and run a grain separator, 28-inch cylinder, pull five plows in the field and run a small capacity rock crusher and concrete mixer in road making work. A. The track laying or "caterpillar" tread type tractor should prove satisfactory in every respect for the work you mention. In fact, many of the logging engines used over snow covered roads in hauling a train of heavily loaded sledges employ this chain tread traction member. They have also been successfully utilized for hauling heavy artillery over very poor, partially destroyed roads and even across country. We would advise either this form or four-wheel drive where traction conditions are not good. These tractors may be procured equipped with engines of 50 to 60 horse-power.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

CLAMPING AND HOLDING MEANS FOR SHOE UPPERS.—S I. DEER, 364 New St., Emans, Pa. An object here is to provide a device for clamping and holding uppers preparatory to marking the spaces for buttons thereon. A further object is to provide a construction which will engage and hold the uppers properly in position while the same are being marked.

CHILD'S WAIST.—TILLIE ROSENBAUM, 501 W. 149th St., New York, N. Y. The invention provides a waist with suspension members expansible to accommodate the growth of the wearer; provides garment-supporting members to relieve the body from the carrying or supporting strains; provides a garment employing shoulder-straps with adjustment devices for retaining said straps in service position on the body; and provides auxiliary supports or retainers for preventing disadjustment of the shoulder-straps of under-vests on similar garment.

Pertaining to Aviation

AEROPLANE.—J. B. GROSS, address Joseph W. Connelly, 13 E. Hamilton Place, Jersey City, N. J. One of the main objects of this invention is to provide a relatively great area of sustaining surface; another is to provide a positive control of the steering and stabilizing means. A further object is to provide means for warping the ends of the sustaining planes in the proper directions and degrees simultaneously.

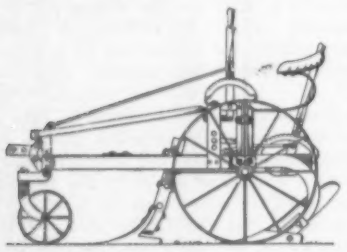
Electrical Devices

ELECTROHYDRAULIC GUN.—R. C. HILL, Box 1017, Memphis, Tenn. An object of this improvement is the provision of a gun whose action is effected jointly by means of electricity and hydraulics. A further object is to provide a gun which may be operated without the necessity of using an explosive charge.

Of Interest to Farmers.

ATTACHMENT FOR CULTIVATORS.—G. L. MILLER, Address Charles G. Davis, Lawyer, 112 S. State St., Geneseo, Ill. This invention is an improvement in attachments for cultivators, and has for its object to provide mechanism of the character specified, especially designed to destroy and eradicate weeds growing close to the stalk in the row, which are not reached by the shovels of the cultivator.

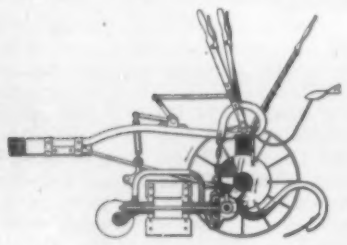
PLOW.—H. F. HILDEBRANDT, Maxwells, Tex. This invention is an improvement on plows, and the inventor has for his object the provision of a plow or lister adapted for use as a



PLOW OR LISTER.

riding or a walking plow, wherein a wheel supported frame is provided, and a plow supporting frame so connected that they may be separated to permit the use of the plow as a walking or a riding plow.

COTTON CHOPPER AND CULTIVATOR.—J. J. EARGLE, Newberry, S. C. The invention refers to cotton choppers and cultivators and one of the principal objects of the improvement is to provide such a machine having a rotary



COTTON CHOPPER AND CULTIVATOR.

cutter suitably supported in an adjustable carriage and adapted to be operated from the ground wheels of the machine at various rates of speed.

CULTIVATOR.—W. F. LAMP, Mohler, Wash. The cultivating mechanism in this mechanism is a series of concave-convex disks arranged with their convex faces upward and each provided with a radial vane on its upper face, the disks being mounted in the same plane on a wheel-supported frame and being driven from the wheels of the frame, and being mounted on an auxiliary frame which is adjusted vertically with respect to the main frame, the disks being arranged in a row and spaced apart from each other to permit the rows of plants to move between adjacent disks.

Of General Interest

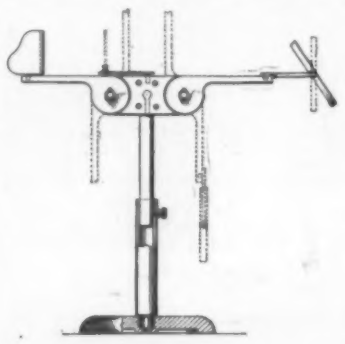
GUN CARRIAGE AND PROJECTILE.—E. E. GREGORY, Lewisport, Ky. The invention relates to a device for use in gun carriages to serve as a wad and gas-check in shooting stream-line bullets or other projectiles, including bombs. The device is cup-shaped, and it may be made in various sizes and modifications in regard to details of shape and construction.

CHEMICAL FIRE EXTINGUISHING SYSTEM.—P. B. BARRINGER, Charlottesville, Va. An object here is to improve the construction of the containing device for the liquid chemicals, so that the mixing of the chemicals can be effectively brought about by the pneumatic pressure in the pipe system through the firing of the explosive material of any nozzle.

OBSERVATION APPARATUS. — G. T. FIELDING, 2186 Loring Place, Bronx, N. Y., N. Y. The object of the invention is to provide a new and improved observation apparatus more especially designed for use by military persons and arranged to enable a person to safely observe distant bodies of men or other objects without danger of exposure.

CHIMNEY COWL.—H. GUTSCHMIDT, 574 Palisade Ave., Jersey City, N. J. This inventor provides a chimney cowl arranged to provide a free, unobstructed escape of the smoke coming up the chimney or smoke slack on which the coal is supplied, and to prevent back draft especially when high winds prevail and in case the cowl is located adjacent the wall.

ORNAMENTAL STAND.—N. Q. FRETWELL, Route 3, Box 52, Fort Worth, Tex. The invention provides a stand of improved construction having arms pivotally connected therewith in a novel manner and adapted to support a stereoscope and mirror or a piece of



ORNAMENTAL STAND.

statuary or like article, said arms being adjustably connected with the stand and being adapted to be readily revolved about the stand as an axis to bring them into the desired position.

Hardware and Tools

WELL DRILLING TOOL.—J. V. RIDLEY, Sr., and A. G. RIDLEY, Water Tower Block, Newport, Ark. This invention provides a tool which will facilitate the sinking of artesian wells or other small bore wells. It also provides a drill point which is designed to be rotated and by means of which the earth is pressed outwardly, thereby facilitating the entrance of the drill point proper.

URETHRITIC SYRINGE.—G. J. DUGGAN, address Becton, Dickinson & Co., Rutherford, N. J. This invention relates to urethritic syringes consisting of a glass barrel and a rubber bulb for drawing the medicated liquid into the barrel and ejecting it through the nozzle thereof to an affected part. It provides a syringe of the type mentioned, and arranged to prevent the liquid drawn into the barrel from flowing into the bulb in holding the barrel with the nozzle upward.

Heating and Lighting

FEED WATER PURIFIER AND BOILER SKIMMER.—H. M. NYE, 2601 R St., Lincoln, Neb. The object of the invention is to provide a feed water purifier and boiler skimmer arranged to readily remove the sediment contained in the feed water prior to passing the latter into the boiler, and to remove oil or other matter floating on the surface of the water in the boiler.

GRATE.—C. W. HOPES, 4 Smith St., Glens Falls, N. Y. In the present patent the inventor employs grate-bars carried by special supporting bars which, in turn, provide for the upward passage of air therethrough in order to insure fuel combustion directly over the supporting bars as well as over the grate-bars, thereby resulting in high efficiency and complete combustion of the fuel, even though of low grades.

AUTOMATIC RELEASING DEVICE.—A. J. TISLEY, 15 Chester Court, Flatbush, Brooklyn, N. Y., N. Y. The device is constructed with a lever on one arm of which a weight is disposed, the other arm being engaged by a shoulder on a second lever, positioned at an angle to the first lever. When the second lever is operated it frees the shoulder from the first lever to permit the first lever to move to free the weight therefrom, thereby permitting the fall of the weight to operate means connected with the feeding apparatus or the furnace drafts.

Household Utilities

HOLDER OR SUPPORT FOR BATH SPRAY PIPES.—G. RUBIN, 203 E. 174 St., Bronx, N. Y., N. Y. This invention is an improvement in holders or supports for spray pipes used in bathtubs, and adapted to be secured to the edge of the same adjacent to the discharge cock. Means provide for the bather quickly adjusting the angle of the spray upon his head, shoulder and arms, or upon the lower portion of the body, as desired.

DRAINAGE AND VENT FITTING.—C. S. C. ROCK. Address M. A. Farrell, 275 Water St., New York, N. Y. This invention provides a fitting designed to connect the soil pipe with the vent pipe and adapted to connect with bath tubs, sinks, water closets and other fixtures to be drained and vented, the arrangement being such that the plumber can readily assemble the parts and make the connections so that the proper drainage and venting is insured.

WARDROBE.— F. N. BARDWELL, 98 Howe St., Passaic, N. J. The main object here is to provide devices which may be moved from one place to another, as a whole, which may be collapsed for storage or shipping, and which presents the unique appearance of an entirely different article of furniture, such as a screen or other article.

HINGED RETORT DOOR.—N. TROYER And F. C. FOX, Astoria, Ore. This invention has reference more particularly to a hinged door for use on a retort or receptacle used for cooking fish, fruits, vegetables and food materials by steam, hot water or other artificial means, after the material has been placed in cans, glass jars, or other receptacles.

SANITARY VENTILATED GARBAGE CAN.—E. MAYER And M. E. WOLFF, 281 Edgecombe Ave., New York, N. Y. This invention is more especially adapted in connection with a garbage can so as to permit the use of a liquid disinfectant, the odors arising from which will permeate the contents of the can for purpose specified, while means are provided to prevent the disinfectant from escaping when the can is emptied.

SANITARY CLOSET SEAT COVER.—H. G. A. MOREN, 1250 E. 10th St., Brooklyn, N. Y., N. Y. This invention has for its general objects the provision of a device which is light, durable, cheap, sanitary and foldable, so as to adopt it for individual use, it being foldable so as to be conveniently carried or stored away when not in use.

COFFEE MAKING APPARATUS.—A. Mintz, 206 E. 5th St., New York, N. Y. This invention relates to coffee-making apparatus, and has reference particularly to an apparatus wherein the coffee pots are heated by hot water supplied from a boiler which is external to the coffee-pots and whereby economy of burners and, therefore, of fuel is obtained.

Machines and Mechanical Devices

INKING DEVICE FOR PRINTING MACHINES.—Jean Carrelet and Laurent D. DeLonlay, 144 Rue Montmartre, Paris, France. This invention obviates several inconveniences and consists in forcing ink or color under pressure through an ink reservoir made of a porous substance which constitutes at the same time the support of a printing block or plate with openings, made of a comparatively non-porous substance applied directly to the ink reservoir in such a way that the passage of the ink or color to the printing block or plate takes place to the exclusion of air and it thus becomes possible to employ inks and colors which dry rapidly.

BLOW-OFF VALVE.—83 Court St., Newark, N. J. This invention provides a valve structure of a compound nature embodying the characteristics of the now well known check valve to retain the air within the tube and having also an auxiliary valve mechanism permitting any excess pressure over the predetermined degree to be discharged while the first mentioned check valve becomes seated, retaining the precise desired amount of pressure within the tube.

PUMP.—C. T. HARDING, Fayetteville, Ark. This invention provides a plurality of pumps such, for example, as a reciprocity air pump for charging the compressed air tank, and a rotary pump for causing positive circulation of water through the radiator and other parts of the machine, and pumps to be operated simultaneously or otherwise from a single source of power, peculiar means being provided to control the operation of the pumps from said source of power.

WATER METER.—H. J. WOODMAN, Fort Laramie, Wyo. This invention comprises means for practically automatically registering the amount of water delivered from an irrigation-ditch for individual use by the irrigator. A rotary wheel is placed in the water and maintained by the water at a definite elevation below the surface thereof irrespective of the rise or fall of water in the main body or ditch. From this wheel a rotary cam wheel is operated at a relatively slow speed, and the cam wheel checks off the distance interval of water passing through the measuring box which is of definite width. The cam wheel determines the automatic rise and fall of means for registering the depth of water flowing through the box.

CHECK DISPLAYER.—H. M. GODBERSON and T. H. MONTGOMERY, care of George McHenry, Denison, Iowa. The primary object here is to enable one to compare the amount of the last check inserted into the displayer and that recorded on the cash register. The invention provides a convenient and inexpensive check displayer which will show not only the last check recorded but some of the previous checks.

MECHANOTHERAPEUTIC APPARATUS.—S. J. ALBERT, 20 Avenue Secrétan, Paris, France. The apparatus is adapted to strengthen the muscles and to destruct the ankylosis of the members. It comprises a kind of crank provided with a weight and actuated by the person under treatment, either by means of the hand corresponding to the sore arm, or by means of the foot corresponding to the sore leg through the medium of a treadle, so as to cause said sore organs to effect a certain work from which the suitable curative effects will be obtained.

CHANGE MAKING MACHINE.—H. ABRAMOVITS, 131 Eldridge St., New York, N. Y. This improvement relates to coin handling devices and has particular reference to means whereby a cashier may by simple and easily operated mechanism deliver to a purchaser or a customer the necessary change when a purchase is made and a sum of money in excess of the purchase price is tendered.

FRICTION CLUTCH.—H. W. LUDLAM, 44 W. 37th St., Bayonne, N. J. This inventor provides a clutch which acts quickly and effectively to make driving connection between two principal members a certain amount of resiliency between the members as is desirable in many instances, and providing a direct release for relatively reverse movement of the driving member in a noiseless manner.

ELEVATOR INDICATOR SYSTEM.—F. A. BOETTCHER, 413 W. 41 St., New York, N. Y. This invention relates to improvement in elevator indicators and systems of control therefor, and has for an object to provide an improved structure for causing the indicator at various floors to exhibit information showing the position and direction of travel of the elevator.

LIQUID METER.—A. MASS, 225 So. 11 St., Newark, N. J. The invention provides an apparatus with means for showing the amount received and the amount delivered through said apparatus; counterbalances unpremeditated pressures exerted by the fluid when being passed through the meter; and furnishes an index for informing as to the condition of the supply of liquid on hand and the total consumption of liquid passed through the meter during an extended period.

Musical Instruments

TUNING FORK AND RESONATOR.—W. BERRY, 178 Schenck St., North Tonawanda, N. Y. This invention relates to musical instruments of the percussion type, and its object is to provide certain useful instruments of this type whereby a free ejection of the sound waves is had from the resonator and the volume of the tone is increased.

Prime Movers and Their Accessories

CARBURETER.—B. H. BIAYS, 52-54 Union St., Cumberland, Md. The object in this case is to provide a carbureter in which the fluid fuel is delivered into the mixing chamber in a thin stream, together with a stream of air immediately adjacent, thus providing for a most intimate mixture of the gas or vapor and the air.

CARBURETER.—E. H. ARQUEMBORG, 71 Rue du Moulin Vert, Paris, France. This invention has for its object a system of carbureter of the type called "multiple carbureter," comprising two carbureters which combine their actions so as to give at any moment the carbureter suited to the proper operation of the motor as well when working at a reduced speed as when working at high speeds.

Pertaining to Vehicles

STEERING DEVICE FOR MOTOR VEHICLES.—D. J. SANDHAM, 1861 Cornelia St., Brooklyn, New York, N. Y. This steering device is of substantially universal application to all known types of vehicles, that is to say, Mr. Sandham's steering devices are adapted to be readily applied by any mechanic to practically any vehicle running gear now in use or type of vehicle now being made.

AIR PUMP.—A. R. BERCK and FRED TJADEN, address the latter, Hastings, Neb. The main object in this case is to provide an air pump provided with a self-contained storage chamber for compressed air, whereby the air is continuously forced through the relatively small valve of the tire, regardless of the direction of movement of the pumping element.

ATTACHMENT FOR STEERING MECHANISMS.—R. L. WOOD, Russell, Kan. An object here is to provide a strong and inexpensive device which will not require any alteration in the steering mechanism of a self-propelled vehicle when applied thereto, and which contrivance can be easily and quickly attached to the steering mechanism.

ATTACHMENT FOR CONVERTING A BICYCLE INTO A TRICYCLE.—J. C. FOLEY, 2059 Jerome Ave., Bronx, New York, N. Y. Mr. Foley's invention has reference to attachments for converting a bicycle into a tricycle, and it

has reference more particularly to motorcycle attachments, and has reference more particularly to an attachment whereby a bicycle can be changed into a tricycle. The invention provides an auxiliary attachment whereby the ordinary motorcycle can be easily and quickly changed into a motortricycle, and vice versa.

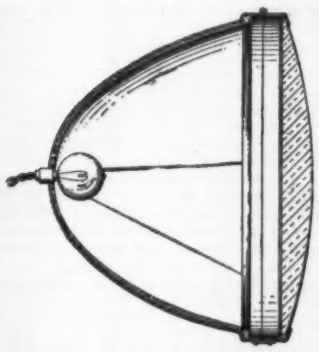
AUTOMOBILE JACK.—F. O. COOLEY, and A. J. MILLIGAN, care of Clyde Iron Works, Duluth, Minn. This improvement relates to jacks of the type in which provision is made for jacking up both the front and rear axles of the vehicle. It provides automobile jacks of the type indicated improved in various particulars to the end that convenience in operation may be promoted, as well as simplicity of construction.

SIGNALING DEVICE.—M. J. MANDELBAUM, care of Lucien Zeel, 170 Broadway, New York, N. Y. This invention provides a signaling device for automobiles and similar vehicles, and arranged to permit the chauffeur to display warning signals during the day and night to following vehicles whenever it is desired to stop the vehicle or to turn from a straight course to the right or to the left.

ATTACHING AND CONCEALING MEANS FOR VEHICLE CURTAINS.—Broadly, the invention comprehends the provision of pockets along the edges of the top adjacent to which the curtains are attached and designed to be folded or otherwise compactly arranged to be retained in the pockets in a relatively concealed position but in such manner as to be capable of being readily lowered when they are desired to be used.

WHEEL FOR TRACTION ENGINES.—F. R. NYBERG, 104 N. 8th St., Lamar, Colo. The invention provides mechanism in connection with the usual drive wheel, for permitting the mud cleats usually used on the periphery of the wheel to be dispensed with, and wherein the said mechanism is so arranged that it may be brought into and out of operative position whenever desired, and wherein a series of holding dogs is provided, movable radially of the wheel, and operated by a cam, to cause them to protrude at any desired point in the periphery of the wheel, and wherein other mechanism is provided for preventing injury to the machinery or to the wheels or dogs from solid bodies in the road.

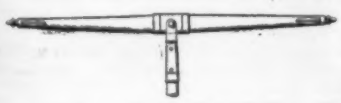
HEADLIGHTS FOR VEHICLES.—FRANKLIN P. SACKETT, 177 George St., Providence, R. I. The invention produces a headlight for automobiles, trolley cars and other vehicles from which the upwardly projecting rays are



HEADLIGHTS FOR VEHICLES.

removed. It produces a reflector for the headlamps in which the sector of the reflector adapted to project the rays from the burner upwardly and toward the side on which another vehicle will approach traveling in the opposite direction is made blank or of non-reflective surface.

NECK YOKE ATTACHMENT.—C. E. REDFIELD, Ashland, Wis. This invention provides an improved center whereby the neck yoke



NECK YOKE ATTACHMENT.

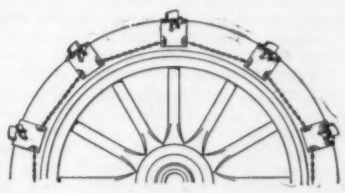
may be positioned in advance of the vehicle tongue, in order that the reins may not become entangled or engaged under the end of the tongue. It provides a neck yoke attachment in the form of a strong connection between the yoke and the vehicle tongue, this connection adapted to allow movement of the yoke incident to the movement of the draft animals.

GREASE GUN.—H. M. DAVIS, 122 Lake St., Yonkers, N. Y. The invention provides a gun adapted to be inserted between two leaves of leaf springs after they have been separated by means of a tool and from which the lubricant may be forced in desired quantity and at desired points by one hand of the operator; provides a special tip for use which insures the delivery of ribbons of lubricant of uniform thickness, whereby a thin film of the lubricant is deposited upon one or both of the separated leaves; and provides means for recharging the gun with lubricant.

HANDLE BAR GRIP.—T. F. STANTON, Denton, Kan. The invention relates to a grip for the handle bar of a motor cycle and the like, and particularly to a grip in the form of a wire coil adapted to be slipped onto the handle bar to retain its position by the springing action of the coil at one end, the opposite end being designed to project beyond the handle bar and form the shock absorbing grip.

VEHICLE WHEEL TIRE.—F. V. UBEZZI, 39th St., and First Ave., New York, N. Y. This invention provides a collapsible wearing shoe having adhesive properties with means for expanding said shoe to, and for maintaining the same in, service form: provides a collapsible tire and spreader therefor adapted for employmeat in connection with a demountable tire rim; and provides a tire relatively immune from such accidents as impair the service condition thereof.

TIRE CHAIN.—L. W. CLASKA, Garden Valley, Idaho. This invention provides a device capable of being attached to any construction of pneumatic tire or detached therefrom, wherein a series of gripping devices is provided, each in the form of an arc-shaped plate or chip having spurs or lugs on its convex face and adapted to be arranged trans-



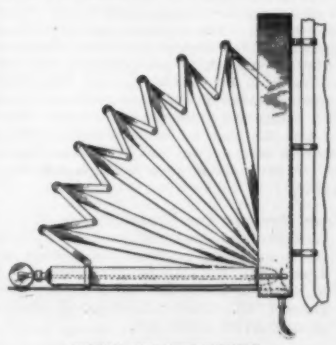
TIRE CHAIN.

versely of the tread of the tire, the said plates being connected together by flexible members on opposite sides of the tire, and wherein mechanism is provided in connection with the flexible members for permitting the device to be placed on the tire or removed therefrom.

MOTOR TRUCK.—C. T. ELDREDGE, Stockton, Cal. This invention supplants the conventional front wheels by one wheel so arranged as to be capable of a relatively great degree of vertical movement with respect to the frame, whereby the jolting now common in such vehicles is very materially lessened, thus resulting in easier riding qualities, less destructive effect on the motor and freight, permits the use of metal tires with the consequent saving, prevents torsional strains on the frame, and permits the use of larger wheels with metal tires which adapt the vehicle to rough, mountainous, and stony roads.

KILN CAR.— C. E. EVANS, Weed, Cal. This invention provides a car having a main frame and an auxiliary frame movable relatively thereto, on which the lumber or other material is disposed, a bed and a stake of the auxiliary frame connected by links with a bed and a stake on the main frame so that when the auxiliary frame moves down under the weight of lumber or other material and relatively to the main frame, the links will move the auxiliary frame to press the lumber or other material between the stake on the auxiliary frame and another stake on the main frame.

SIGNAL FOR AUTOMOBILES.—H. ROSE, care of Henry Rose Merchant and Manufacturing Co., Shreveport, La. One of the principal objects of the invention is to provide a danger signal which may be operated by the driver



SIGNAL FOR AUTOMOBILES.

and which may be seen equally from the front or from the rear of the vehicle to which it is attached, the signal being so constructed as to provide for the ringing of a bell in the day time and the illumination of a light at night time, so as to notify drivers of following and approaching vehicles of an intended turn or stop.

Designs

DESIGN FOR A RADIATOR MASK.—D. MCRA LIVINGSTON, 159 E. 36th St., New York, N. Y. This ornamental design is shown in two figures. The first is a front perspective view of a radiator mask embodying the new design; and the second is a perspective view taken at the side.

DESIGN FOR AN AUTO PEDAL PAD.—J. WINKLER, 794 7th Ave., Brooklyn, New York, N. Y. In this ornamental design the pad is shown in two figures. The first is a plan view of the pedal pad; and the second is a side view.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Making of X-Ray Tubes in War Time

(Concluded from page 96)

the tube which prolongs it, following which the metal faces are polished. This member is then sealed in the end of a glass tube in which air is exhausted in order to determine if there exist interstices in the solder or if the union between the glass and platinum is an imperfect one. After a test lasting about three days, the piece is placed in a stock room where it remains for a certain period before use.

The metallic pieces or electrodes, finished and tested, pass to the glass blowers who work the glass into a ball provided with a neck, which ultimately becomes the neck of the cathode. According to the type which the finished tube is to represent, the worker places a number of projections on the bulb—one for holding the anode, one for the anti-cathode and one for the regulator, for instance. This work is obviously of a most delicate character and requires blowers possessing a high degree of skill. The last step in this phase of the work is the placing of the metallic pieces in their proper positions, followed by the melting of the glass around them so as to seal them in place. The tube is then exhausted and left in that condition for several days to determine whether there are variations in the vacuum due to faulty sealing.

After the bulbs have passed the test just mentioned, they are sent to another department to be permanently exhausted to the required degree. Connection with a bulb and the pump is usually made by a prolongation of the regulator chamber. Aside from the pumps for exhausting the air from the X-ray tubes, this department of the factory contains apparatus for the production of electric currents of high potential, a switchboard and instruments for electrical measurements.

After the first few minutes of pumping, the tube is connected with a source of electricity. The current in traversing the bulb heats the metal members, causing them to release the gas which they contain. The gas is absorbed by the pump. When the bulb reaches the high state of exhaustion desired, the pump is shut off from the bulb, but not disconnected, while tests are made to determine whether, despite the severe electric treatment, there is still an excessive quantity of gas which has not been disengaged from the metallic members. After these tests the tube is permanently sealed by the application of heat to the neck through which the exhaustion was effected.

It is interesting to note the means of protection employed in the pumping room for insuring the employes against X-ray burns. Each testing post is surrounded by a wooden screen covered with a thin sheeting of lead. The screen is provided with windows of three-ply glass through which the rays cannot pass, although the operator can readily see the operation of the tube under test through them. All controlling apparatus is placed outside the screen where it can be manipulated by the workers without exposing themselves to the rays.

From the pumping room the tubes pass on to the first laboratory where they are tested in order to determine whether their action is normal. They are then placed in the hands of a woman worker who fits on the radiator member, cements the caps in place, solders certain exterior metal parts together and performs other operations necessary to complete the X-ray bulbs. Although now completed, the bulbs are still retained in the factory for another eight or ten days during which they are subjected to a series of exhaustive experiments in different laboratories. Then, and only then, are the X-ray tubes shipped out.

In the short space of 18 months, France has not only built up an X-ray tube industry which supplies all the needs of her army, but in addition to this she is in a position to furnish X-ray apparatus to her allies. Furthermore, despite the large needs of the fighting forces, it has been found possible also to provide the health officials and public and private hospitals with these all-important tubes.

NEW BOOKS, ETC.

RUBBER MACHINERY. By Henry C. Pearson, Editor of *The India Rubber World*. New York: *The India Rubber World*, 1915. 8vo.; 419 pp.; illustrated. Price, $6.00 net.

Mr. Pearson has made numerous helpful contributions to the literature of rubber, most of them dealing with the material in its growing or crude state. In this, his latest work, he shows us the various machines used in fashioning the crude rubber into the finished fabric or device sold to the ultimate consumer. The equipment by which such processes as washing, drying, mixing, calendering and vulcanizing are accomplished is shown by means of cuts which carry with them descriptions sufficiently detailed to make each part and its action clearly discernible. There are also sections dealing with cement and solution machinery, extraction and reclamation processes, and rubber laboratory equipment. The value of the work to the manufacturer is apparent and, since rubber processes are still very imperfect from a mechanical point of view, the inventor also should profit by a close study of the volume.

PRACTICAL SURVEYING. For Surveyors' Assistants, Vocational, and High Schools. By Ernest McCullough, C.E. New York: D. Van Nostrand Company, 1915. 8vo.; 401 pp.; 229 illustrations. Price, $2 net.

In one respect at least the author's exposition differs from the usual text-book on this much-handled subject; instead of assuming on the part of the student a knowledge of algebra, geometry and trigonometry, he meets the needs of those whose knowledge is confined to grade school arithmetic. An appendix gives an excellent summary of the essentials of algebra, while the necessary trigonometry is incorporated in the body of the work. The text may be used to advantage in schools and evening classes, and it lends itself admirably to the use of the self-taught surveyor's assistant who has the ambition of becoming a full-fledged surveyor.

PRACTICAL FORGING AND ART SMITHING. By Thomas F. Googerty. Milwaukee, Wis.: The Bruce Publishing Company, 1915. 8vo.; 146 pp.; illustrated.

A most attractive and helpful handbook is here given us by a master craftsman who adds to his manual attainments a practical knowledge of teaching. His experience is conveyed to the student in a graded series of lessons, in which the points of the art are set forth in exact statement and unstinted illustration. This text should do much toward introducing good forging practice into the school shop, and teachers and workers alike must appreciate the beauty and utility of the many designs it presents.

LABORATORY MANUAL. Arranged to Accompany "A Course in General Chemistry." By William McPherson and William Edwards Henderson, Professors of Chemistry, Ohio State University. New York: Ginn and Company, 1915. 8vo.; 141 pp.; illustrated. Price, 60 cents.

This outline, designed to supplement the authors' "A Course in General Chemistry," has long been used in their own laboratories. It meets the requirements of the average time devoted to such work in college classes, calls for no unusual apparatus, and is so arranged that certain of the quantitative experiments may be omitted by the beginner, while the simpler tests intended for those taking an elementary course may be passed over by the student who has already had the advantages of elementary instruction.

LESSONS IN ELEMENTARY PHYSIOLOGY. By Thomas H. Huxley, LL.D., F.R.S. New York: The Macmillan Company, 1915. 8vo.; 604 pp.; illustrated.

Huxley's "Psysiology" is too well-known to need any explanation or commendation. This enlarged and revised edition brings the work into line with the progress made during the last twenty years. Such portions of the original work as still hold true and sufficient in the light of modern research are left untouched; but the reviser has shown great skill in introducing present-day knowledge wherever such interpolation is necessary, and the result is the wedding of Huxley's force and clarity of statement to the wider detail and the closer accuracy of our enlarged conceptions.

THE INTERNAL COMBUSTION ENGINE. A Text-Book for the Use of Students and Engineers. By H. E. Wimperis, M.A., M.I.E.E. New York: D. Van Nostrand Company, 1915. 8vo.; 319 pp.; illustrated. Price, $3 net.

There have been many important developments since the first edition of this book was printed. The increasing usefulness of the internal combustion engine on land was even then a foregone conclusion, but in addition to this growth we have witnessed its rapid adaptation to the requirements of the other elements—sea and air. The author has, in the present edition, availed himself of all sources of information dealing with both theory and practice. The result is an almost rewritten exposition, covering well the most modern aspects of its subject. As a member of the Gaseous Explosions Committee, appointed by the British Association, the author is exceptionally qualified to set forth the valuable deductions of this body, and a summary of its findings is a part of the present work. Students and engineers will appreciate the many advantages of arrangement and discussion.

MINING AND MINE VENTILATION. A Practical Handbook of the Physics and Chemistry of Mining and Mine Ventilation. By Joseph J. Walsh. New York: D. Van Nostrand Company, 1915. 8vo.; 180 pp.; illustrated. Price, $2 net.

In this text the fundamental theories of ventilation receive a more thorough consideration than is usually met with in similar works, and some new material is offered. The book aims, also, at furnishing the student with a more suggestive method of study in a more graphic form. Among new features may be mentioned the manner of determining the size of fan to ventilate a mine under given conditions, and certain facts relating to the water gauge. The chapter on mine fires constitutes a commendable addition to the work.

DIVERSIONS OF A NATURALIST. By Sir Ray Lankester, K.C.B., F.R.S. New York: The Macmillan Company, 1915. 8vo.; 424 pp.; illustrated. Price, $1.75 net.

From time to time Sir Ray Lankester gathers together some of his interesting papers appearing in the *Daily Telegraph* under the title, "Science from an Easy Chair." No one knows better how to make out-of-the-way facts of nature attractive to a wide public. Since, for example, a wide-spread belief once existed to the effect that barnacles hatch out into a particular kind of goose called the "barnacle goose," the author piques curiosity by a short history of the belief and its reluctant death. Curious old modes of thought and actual facts thus blend to rivet attention and to point his lessons. Courtship among animals always offers an amusing study, and several chapters deal with this subject. Birth-marks and diet, palmistry and the divining-rod, all contribute their quota to the volume, and the author's style is so easy that even the devotee of the detective story should not find it dry reading.

SELECT NOTES ON THE INTERNATIONAL LESSONS, 1916. By Rev. F. N. Peloubet, D.D., and Prof. Amos R. Wells, Litt.D., LL.D. Boston: W. A. Wilde Company. 8vo.; 376 pp.; illustrated. Price $1.

All Sunday School worker's know what the International Lessons are. This handbook is applicable to the work of all grades, and ably seconds the teacher in his work of exposition with hints, illustrations, and explanations of the text. There are ample library references to aid him in any researches he may desire to make, and many subsidiary helps in the form of maps, pictures, quotations, and subjects for discussion. As a study in typography it compels the attention. Rarely have such difficulties in type been overcome in such a masterly manner.

THE MODERN MOTOR CAR. A Book of Simplified Upkeep. By Harold P. Manly. Chicago: Laird & Lee, Inc., 1914. 12mo.; 506 pp.; 217 illustrations. Price, $2.50.

"The Modern Motor Car" is a very clear exposition of the means to be employed in operating and caring for the automobile so that its efficiency may be maintained for the longest possible time. The construction, care and adjustment of the various parts are plainly set before the student, as are also shop and roadside methods of trouble location and repair. Hints are given on the wise purchase of supplies. Students, salesmen, drivers and repairers will find here a fund of briefly-stated yet adequate information that will help them to get the most out of their business and out of the car.

TEST METHODS FOR STEAM POWER PLANTS. A Reference Book for the Use of Power Station Engineers, Superintendents, and Chemists. By Edward H. Tenney, B.A., M.E. New York: D. Van Nostrand Company, 1915. 12mo.; 224 pp.; 85 illustrations. Price, $2.50 net.

These papers convey that knowledge concerning conditions and details of the steam power plant by which alone may true efficiency and economy be attained. They give, within the scope of a single volume, a grasp of the situation that will enable the conscientious engineer to keep his costs at the lowest figure. Fuel, furnace arrangement and operation, and boiler cleanliness are factors receiving thorough consideration. The test methods are authoritative, and of two or more methods equally efficient the most simple and speedy one is given the preference. An appendix contains boiler report forms and some valuable tables and equivalents.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES. For Buyers and Sellers. New York: S. E. Hendricks Company, Inc., 1915. 1503 pp. Price, $10.

Buyers and sellers will find this twenty-fourth edition of Hendricks' Commercial Register as eminently satisfactory as ever, with its lists verified, enlarged and corrected by the latest information obtainable up to the hour of its going to press. Particularly full are the directories of the architectural, contracting, electrical engineering, hardware, mechanical, mill, mining, quarrying, railroad, and iron and steel industries. The compilation includes products from the raw material to the finished article with the concerns, from producer to consumer, that handle them. The scope and the established reliability of the Register make it an extremely valuable book for any firm or individual that uses mailing lists, purchases, supplies, or sells goods.

GEORGE WASHINGTON: FARMER. Being an Account of His Home Life and Agricultural Activities. By Paul Leland Haworth. Indianapolis: The Bobbs-Merrill Company, 1915. 12mo.; 336 pp.; illustrated. Price, $1.50 net.

Multifarious are the books dealing with George Washington, but we do not remember to have seen one which confines itself to his home life on the farm. Most people know that he was born on a plantation, and brought up in the country, but few, perhaps, realize that he had reached manhood before he saw a town of five thousand inhabitants. His ideals were centered, not upon military activities and honors, but upon "a good Estate on healthy Soil," and he was withal a man of advanced agricultural views, quick to condemn the careless, wasteful methods of the day, and to apply to his own estate a more intensive culture in line with English thoroughness. As a careful surveyor, he was eminently qualified to draw up a map of Mount Vernon, and this is one of the many interesting exhibits of the volume.

NAVAL HANDBOOK. As Bearing on National Defense and the European War. By Thomas Drayton Parker, Commander, U. S. Navy (Retired). San Francisco: John J. Newbegin, 1916. 12mo.; 80 pp.; illustrated. Price, $1 net.

This manual, small as it is, answers almost any question likely to arise in the mind of the layman. It describes the various types of fighting ships and the particular part each would play in the event of war. The submarine's distinctive features are very ably explained, and guns and ammunition, aircraft, and torpedoes and mines are discussed in brief but intense chapters. The principles of naval warfare are sketched, and such points of international law as are likely to interest Americans at this juncture are skilfully brought out. Primed with the information of this little handbook, the reader should be able to do better than hold his own in an argument involving naval facts. Indeed, so far as his friends and acquaintances were concerned, he might easily pose as an authority.

THE GASOLINE AUTOMOBILE. By George W. Hobbs, B.S., and Ben G. Elliott, M.E. New York: McGraw-Hill Book Company, 1915. 8vo.; 260 pp.; illustrated. Price, $2 net.

The more intimate a driver's acquaintance with the mechanism of his car, the more pleasure and satisfaction he will find in it; moreover, there will be a better economy of operation, and the car will maintain a maximum efficiency for a longer time. "The Gasoline Automobile" was prepared in the Extension Division of the University of Wisconsin, and it extends a strong, helping hand to every man interested in the motor car, whether from the point of view of business or of pleasure; all types are included, and the excellent drawings make clear almost at a glance the salient points of construction and operation.

A TEXT-BOOK OF GEOLOGY. For Use in Universities, Colleges, Schools of Science, etc., and for the General Reader. By Louis V. Pirsson and Charles Schuchert. New York: John Wiley & Sons, Inc., 1915. 8vo.; 1051 pp.; with maps and illustrations. Price, $4 net.

The first section of this work, for which Prof. Pirsson is responsible, deals with physical geology, dynamical and structural. The author has endeavored to maintain a true balance between cultural values and technical requirements, giving perhaps more weight to structural considerations than is usually done. The second section of the work, by Prof. Schuchert, treats the historical side of the science and carefully brings out its relationship to astronomy, evolution, biology and oceanography, and even to botany and zoology, thus broadening the interest of the study and giving due emphasis to its biological bearings. On the whole the author's selection of material and their skillful presentation of it has resulted in a text that should appeal strongly to those seeking a balanced exposition, and its successful use in the Sheffield Scientific School of Yale University further commends it to teachers whose work is largely among those taking professional courses.

THE PRINTING ART. Vol. XXV. March, 1915-August, 1915. Cambridge, Mass.: The University Press. 4to.; 514 pp.; illustrated.

As everybody knows, *The Printing Art* is a monthly magazine that almost ideally combines the practical and the inspirational—though, by the way, true inspiration is the most practical rejuvenator our old world possesses. In dignified binding, these six issues make a very beautiful book, offering us hints from the expert, pointers on business administration, talks to the plain printer, and sound advice upon printed salesmanship. The reproductions in color of book, magazine and catalogue illustrations are masterpieces in their respective fields, and raise the whole volume to a high plane of artistic appeal. Both text and illustration have a distinction that compels attention, yet neither ever fails to be genuinely helpful and stimulating to printer, artist, and advertiser.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14014) F. B. W. asks: Has a successful internal combustion oil engine ever been made, in which continuous combustion is maintained in an independent combustion chamber under pressure, the air supply and fuel supply of crude petroleum oil being injected continuously, the oil going first through an atomizer, the air supply being maintained by an independent compressor, and the expanded lot of gases from the combustion chamber led into cylinders and used in the same way that steam is used in the steam engine. The above being a substitute for the Diesel principle, enabling one to use crude petroleum oil in an internal combustion engine. A. So far as we are aware, the suggested principle for internal combustion engines has never been applied. The nearest approach to it, of which we have seen data, is a German internal combustion turbine. In this turbine the combustion takes place in independent radial cylinders, or rather combustion chambers, and the gases under pressure are led against the rotor. The combustion takes place in consecutive chambers. Check valves at the outlet of the chambers permit the necessary scavenging of the chambers. This scavenging of the cylinders is necessary because combustion cannot be maintained in depleted air. In the two-cycle Diesel type this scavenging is accomplished by the admission of fresh air at about 12-pound pressure for 8 or 10 deg. of the cycle just prior to the admission of a fresh charge of fuel. In the ordinary two-cycle type this same end is obtained by means of a baffle-plate on the top of the piston; this plate deflects the fuel charge to the top of the cylinder under the pressure obtained by the crank-case compression, and the exhausted charge is forced out by the fresh charge. We are at a loss to see how continued combustion may be maintained in a closed cylinder.

(14015) C. W. E. asks: Please tell me thru your "Query" column if the water on the up-stream side of a dam has a buoyant effect upon the structure of the same? A. Unless great care is taken to exclude all water from the foundation of a dam, it has a very decided effect on the stability of the structure. The ordinary gravity section dam depends entirely upon its weight for resistance against the overturning effect on the head of water against it. If there is hydrostatic pressure under the dam, the weight of the dam, in so far as the resistance to overturning is concerned, is cut down by an amount equal to the entire upward pressure against its base. Within the last few years the "Ambrusen" type of dam has sprung into use for locations where it is impossible to exclude the water from the foundations, as in sand or gravel. This type has a reinforced concrete deck, with a flat slope, and the water over this deck adds its weight to that of the concrete in the dam, and the resultant pressures are more nearly vertical than in the vertical faced dam. This deck is supported by buttresses, which have perforated spread footings. In this way the area of the base against which the upward pressure is exerted is reduced to a minimum, as any water which may leak under the toe is allowed to run off. Failures have occurred in gravity dams where the section was safe against overturning, even with the pressure under the base, because of the decrease in the frictional resistance against sliding due to the decreased weight of the dam.

(14016) W. W. asks: Can you give me dimensions to make an electro-magnet coil for remagnetizing magnetic magneto, size of wire to be used on a 110 volt circuit. Must the wire be put on even length of coil and how many turns? What size of lamp to convert in the circuit? How can I tell when magnets are weak and when they are fully charged? Can magnetism be measured? A. You can make an electro-magnet for charging steel magnets by winding a coil of one ohm resistance of double cotton-covered copper wire on an iron core and connecting it in series with a lamp bank of incandescent lamps. Of course direct current must be used. The iron core may be a ⅜-inch soft bar iron bent into U-shape, with the wire wound on the bend and around on each arm of the U. If you would make a neat job you should make two coils of the wire and have two iron bars about three inches long with a cross piece to which one end of each bar is fastened by a screw. The cross piece should be as large as the bars in section. A coil may be made for each bar upon a spool which will slip over the bar with a close fit. To get sufficient current you can use an arc lamp, or a bank of incandescent lamps. Ten 32 candle carbon lamps in multiple will give sufficient current. If you use No. 20 wire 100 feet should be taken. Of No. 16 wire 250 feet should be used. The magnets are weak when they will not do their

work. A magnet will be charged by the coil described in a short time, a minute or so. You may also test it by its lifting a weight. See what it will lift before and after charging. A magnetizing force can be measured.

(14017) E. W. asks: Can you give me any information through your correspondence column whether there is any scientific basis for the claim that gasoline will explode when strained thru chamois skin? Is the article enclosed perfectly true? Do you think this information worthy of widespread knowledge through your paper? A. Gasoline is strained through chamois skin very commonly when it is poured into the tank of an automobile or other gasoline engine. The statement that gasoline and chamois skin are a fatal combination is on its face rather open to doubt. To test the matter we arranged a delicate electroscope in connection with a gasoline strainer and a metal gauze so as to get an indication if any electricity was generated by the friction of the gasoline against the chamois skin. We repeated the experiment several times without getting the slightest indication in the electroscope. Moreover, it requires rather a hot spark to ignite gasoline vapor, hotter than can be produced by gasoline filtering through chamois skin. There is nothing impossible about the generation of a small charge of electricity by the friction of one insulator against another, but in this case we are not able to detect it. We cannot say that we think the statement of the article which you send is true; certainly the "Scare Heading" is not justified by our results.

(14018) G. L. P. asks: Suppose that the earth is a perfectly shaped sphere and measures exactly 25,000 miles in circumference at the equator. If under these conditions we have a thin, steel, non-stretchable band measuring exactly 25,000 miles in length, this if laid around the earth opposite the equator would make all sides of this band touch the earth at all points, and the ends of the band would just meet. Suppose we elongate this steel band 300 feet, so that it measures 25,000 miles, 300 feet long, and then arrange it so that the ends just meet, and that this band forms a true circle, and lay it concentrically over the earth's sphere at the equator, would not the distance between the earth and band at all points be approximately 48 feet, or, in other words, would not this band in this case be about 96 feet larger on its inside diameter than the earth? A. You are quite correct in supposing that a band which just fitted a perfect sphere would stand off the sphere about 48 feet if the band were lengthened 300 feet. It makes no difference what the size of the sphere is, whether it be the earth, or a glass marble. We give you the solution for the benefit of your engineering friends. Let C be the circumference of the sphere, and x the increase in diameter, then $C + 300 = \pi (D + x) = \pi D + \pi x$, but πD is the circumference, and therefore $\pi x = 300$. If $\pi = 3.1416$ $x = 96.5$ feet, very nearly. Hence the band stands off 48.25 feet. You see the circumference of the sphere does not affect the result.

(14019) G. W. Y. asks: I am trying to learn to identify some of the stars and groups of stars, but am only an inexperienced amateur at the work. I have been observing a very brilliant star since August, which rises in the east or southeast in nearly the same place as Orion, and is seen now at about 10:30 in the evening some distance south of the zenith, as nearly as I can guess. I would like very much to know what it is if you can identify it from my description. A. The very bright heavenly body about which you inquire is the planet Jupiter. It is not a star. It is now in the south in the early evening. The star Canopus is never visible in our latitudes. It is a star of the southern heavens. For learning the stars you need a good star map, although the small maps published each month in the SCIENTIFIC AMERICAN can be of great service in tracing the stars. Burrit's Atlas of the Heavens is the plainest for a beginner to use. We can supply it for $1.05 postpaid.

(14020) D. J. H. asks: Is it possible that an object travels faster than the force by which it is being propelled? As in the case of the ice boat, of which our good old sportsmen declare that there and then it went "faster than the wind." A. It is not possible for an object to travel faster than the "force" by which it is propelled, but it is the case that the pressure of the wind may move an ice bont faster than the wind is itself moving. The wind is not moving in the direction in which the boat is moving, that is, the boat is not sailing before the wind, but at an angle with the direction of the wind and the slight friction of the ice upon the runners enables the boat to go faster than the wind. This has often been proved.

(14021) M. K. M. asks: Will you have the kindness to inform me what substance will produce vapor like smoke by drawing on through it? Sometimes this substance is placed in a tube like a cigar and the end placed in the mouth, draw air through it and puff it out like smoke. A. A simple way to produce a smoke-like powder by the chemical action of two gases upon each other is to use ammonia and hydrochloric acid. The combination gives ammonium chloride which is harmless. A drop or two of the acid air blotting paper may be placed in one end of a tube like a cigar, and a drop or two of the ammonia also upon paper may be placed in the other

end of the tube when it is to be smoked. Then draw the air in through the tube and blow the smoke out from the lips as in smoking a real cigar. These chemicals may be arranged in a brazier, or pan so as to blow air gently up through it and the appearance of a smoking fire can be produced very artistically.

(14022) A. M. W. asks: 1. Why was Europe better fitted than Asia to develop the highest civilization? 2. Why not so well fitted as Asia to originate civilization? A. 1. Civilization has developed faster and mounted higher in temperate than in warmer climates. Ninevah and Babylon were near the parallel of thirty north latitude, while the greatest achievements of the human race have been largely made between the parallels of forty and fifty north latitude. South of the parallel of thirty little has been achieved. A hot climate does not dispose men to exertion, and little is won without exertion. 2. We are not able to say why Asia was better fitted for the cradle of the human race.

(14023) W. M. C. asks: My wife has some sterling silver table spoons, and has been buying silver polish to clean them. One day when she decided to clean them up she put the lot in a new zinc bucket with warm water and a little soap to soak a few moments before cleaning. When she went to clean them she found them already clean. A second trial did the same thing, so we save the silver cream. Do we lose the sterling by the operation? Please explain the process. A. The action in cleaning your silver spoons in the zinc pail with soap is an electrical one. A feeble current flows from the zinc to the silver, and since zinc is positive to silver, no silver is carried over to the zinc but a minute quantity of zinc may be carried over to the silver. In cleaning silver in this way, a piece of sheet aluminum and a porcelain or earthen dish are often used. The liquid may be either cooking or washing soda in water.

(14024) L. G. asks: Will you kindly state to us the proof of the following: Two bodies, having the same density, although of different weight, falling from a given height, will reach the ground at the same time. A. Two balls of the same density but of different weights falling through the air from the same height will *not* reach the ground at the same time, except the distance through which they fall be small. The heavier will reach the ground first if they fall from any considerable height. This is because it has more mass with which to overcome the resistance of the air. In a vacuum all bodies, light or heavy, fall with the same velocity, but not in the air. They fall in the air against a resistance and if the fall were far enough a body would come to have a constant velocity. Light bodies come soon to have a constant velocity, as you have doubtless observed.

(14025) D. M. C. asks: Will an iron sphere go to the bottom of the ocean, no matter what the depth? Naturally it would if the density of the water remained the same, but the point has come up that its density increases with the depth due to the settling of the salts and alkalines. I have always understood that in what is called a "mechanical mixture," settling will take place. But in the case of salt water which is called a "chemical mixture," is it not?, there will be no settling, therefore no change of density, and therefore the sphere will go to the bottom. A. An iron sphere will sink to the bottom in any depth of the ocean yet discovered. The deepest Deep thus far found is the Nero Deep, where the bottom was found at a depth of 31,614 feet. Since the density of iron is about 7.75 it does not seem possible that water should ever become as dense as iron, by any amount of compression. It could not be made so dense by dissolving the known salts in it. The salinity of sea water is, on the average, 35 parts in 1,000 by weight. In general the salinity of the ocean water is greatest at the surface, because of the effect of evaporation which is to increase the salinity. There is no settling of salts in the ocean. All the salts found in sea water are soluble in water, and so form what you call a chemical mixture, but may better be termed a solution. It does not differ from a solution of sugar or common salt in water. You will find the subject fully discussed in Sir John Murray's recent book, "The Depths of the Ocean," which we furnish for $7.50.

(14026) G. J. C. asks: There has been some discussion about photographs taken of automobiles going at the rate of fifty or sixty miles per hour, in some cases the top of the wheel appears transparent, while the bottom of the wheel is clear. Some say that the top of the wheel goes faster than the bottom, others say that it is due to optical illusion, which deceives the eye; also the camera. Would you and could you explain this, and oblige. A. It is quite true that the top of a wheel on a rapidly moving vehicle is moving forward faster than the point of the wheel which is in contact with the ground, if this motion is referred to the ground. The point of the wheel which is in contact with the ground is not moving forward at all as referred to the ground on which it rests, unless it is slipping. The part of the wheel which is at the top will in a moment be in front and then it will move down to the ground and up on the rear side of the hub to the top again. You can see that this motion is a complicated one. If you stand by the side of a moving vehicle you can see that the point of the wheel which rests on the ground is not moving forward over the ground,

but is at rest on the ground until it begins to rise into the air again. This will explain why the top of the wheel looks transparent. The spokes go by so fast that the eye gets a continuous view through them because of the persistence of vision.

(14027) J. H. G. asks: Would a substance that would sink to the bottom in ten feet of water sink clean to the bottom in five miles of water, all pressure notwithstanding, and if the same is true of a great ship? A. A substance which is considerably heavier than water will sink to the bottom in the ocean. An iron ship filled with water, will certainly go to the bottom. A substance which is only a very little heavier than water might float at a determined depth. A submarine does this. The air and the water ballast in it are so adjusted as to provide for its floatation at a determined depth.

(14028) H. A. S. asks: 1. A vessel of boiling water may be removed from the stove, while boiling, and set up on the palm of the hand, and retained without discomfort so long as the water continues to boil. Where does the cold come from to cool the metal bottom of the vessel while boiling? 2. A cat may be suspended by the legs, in the air, a few inches from the floor (say six inches), and when released, in this short space, will turn over and strike on her feet. Where does she find the leverage to shift the center of gravity, so as to turn her body over in the short space? A. 1. The explanation of the fact that a kettle of boiling water may be placed on the palm of the hand without discomfort is this: The heat necessary to keep the water boiling comes from the iron of the kettle and thus the iron is cooled, so long as the water boils. The sensation of cold arises from the taking of heat out of the hand by the iron. It is a good conductor of heat and so gives its heat to boil the water and becomes cooler to the hand. When the water no longer boils then the iron becomes too hot for the hand to endure it. 2. The turning of a cat in midair has been a puzzle to scientific men. Pictures of its falling were made by the National Academy of France by cameras before the days of the moving picture camera, which showed the cat in different positions during its fall. These showed wide changes in the position of its body, especially in the humping of its back, the movement of head and legs and the switching of its tail. All these actions doubtless produce the rotation. The remarkable feature of it all is the wonderful rapidity with which the mind of the animal must work to direct these motions.

(14029) S. J. L. asks: Can an electrolytic interrupter be employed satisfactorily in connection with a rotary gap? A. No; a rotary gap will not give satisfactory results when employed in conjunction with an electrolytic interrupter for the reason that the latter does not operate steadily enough. It is far better practice to employ a mechanical interrupter and mount the rotary spark gap disk on the same shaft, so that the interruptions of the circuit and the sparks will be in synchronism. An electrolytic interrupter when used in conjunction with an ordinary spark gap will give fair results where the amount of power employed is not in excess of ⅛ kw. or even possibly 1 kw.

(14030) M. E. P. asks: I am a regular reader of your paper. Would you kindly answer the following question? Prefer answer by return mail. What effect will the burned gases from a gasoline engine have on rubber; that is, when the gas is cooled and cleaned? Will the gases cause the rubber to deteriorate, or will they tend to preserve? A. The gases from combustion do not seem to have any marked effect upon rubber. Rubber tubing is extensively used for carrying gases and seems to last a long time.

(14031) H. G. V. A. asks: It takes the sun's rays or light eight (8) minutes (approx.) to travel from the sun to the earth's surface. "A" contends that, in view of this fact, the sun has *actually* "arisen," eight minutes before we are aware of it, and has "set" eight minutes before. "B" contends that, as sunrise and sunset are purely local phenomena, we are aware of its doing so at practically the same instant it appears or disappears, the only time interval elapsing being that which the sun's light requires to reach the observer from the *horizon*. A. The time given in the almanacs for sunrise and sunset is the time when the upper edge of the sun, as corrected for refraction, is in contact with the sensible horizon of the place. This means that the first ray of the rising and the last ray of the setting sun marks the moment of sunrise and sunset. These rays leave the sun 8 minutes and 19 seconds before they reach the eye, hence the upper edge of the disc of the sun is actually 8 minutes and 19 seconds below the horizon, where it is seen to set at any place.

(14032) H. P. G. asks: "A" claims that if all the compartments of an iron steamship were filled with water, the ship would still float. "B" claims that it will sink under circumstances above mentioned. Which is right? A. If an iron steamship were filled with water it would sink rapidly to the bottom in any part of the ocean. The "Titanic" and the "Lusitania" went down with a plunge, and doubtless they were not completely filled with water until they had sunk far enough so that the pressure of the water burst in the closed compartments. The "F-4" sank and was raised again from a depth of 300 feet at Honolulu.